P I N T L E N O Z Z L E S

Knocking during starting, idle and driving

1. OCCURRENCE

Customers with diesel passenger cars have recently increasingly been complaining of loud combustion noises (engine knocking).

The result of investigation of the pintle nozzles by our specialist department in these cases indicates – apart from a few exceptions – that the nozzles (and nozzle-holder assemblies) are in working order according to the test specifications, i.e. there are no operational or production faults.

The complaint of "knocking" has to do with a combustion-related diesel-specific noise which is tensified under certain conditions.

2. SOURCE OF NOISE

After the vehicle is taken into service or after new nozzles are installed, coking (narrowing of the throttle-gap cross section) is successively built up. The rate-of-discharge curve changes as a result. The time between the start of injection by the nozzle and the start of combustion (ignition of the air-fuel mixture in the engine) is extended.

The longer this time delay – known as ignition lag – becomes, the more fuel enters the combustion chamber by the start of combustion and combustion itself occurs all the more abruptly.

Coking is also determined by the design of the combustion chamber. Robert Bosch has only little influence here, however. The nozzles are tested intensively by the engine manufacturers and are released for each particular engine.

3. TYPES OF NOISE

3.1 Knocking during starting due to large ignition lag. Only occurs until the engine is warm, particularly at low external temperatures. Disappears after 2 – 3 minutes.

3.2 Knocking during driving
Occurs under part load in the lower and upper engine-speed ranges. Unfavorable rate-of-discharge curve promoted by heavy coking. Particularly pronounced during acceleration following a lengthy period at idle.
Does not disappear, even when the engine is warm.

3.3 Rough idling
Occurs in new vehicles or after installation of new injection nozzles.
Disappears in most cases once the vehicle has travelled 500...1000 km.

4. POSSIBLE INFLUENCING VARIABLES

4.1 Fuel
Even though the fuel manufacturers regard our experience skeptically, we observe again and again how vehicles which have taken on fuel at various locations behave very differently with regard to combustion noise. This may occur, for example, due to diesel oil with high-boiling components forming residues to an increased extent and/or when the ignition performance (cetane number = C.N.) of the fuel is lower than the demands which the engine places on the ignition performance of the fuel.

4.2 Operating conditions

4.2.1 Urban traffic
Vehicles which are predominantly used in urban traffic (part-load operation) are more frequently the object of complaint since the engines more rarely reach the necessary operating temperature (approx. 80 °C water temperature). Due to the longer periods of operation in idle (stop and go), the injection nozzles become heavily coked. They are then less intensively flushed by the injected fuel.

The problem here is caused by soft combustion residues, which under certain circumstances may be released again when driving under full load (e.g. expressway).

This applies in particular in winter and to countries where the average annual temperature is relatively low.

4.2.2 Long-distance travel (expressway)
Continous high temperatures promote the disposition of hard combustion residues which can no longer be dissolved.

4.3 Assembly
When installing the injection nozzle in the nozzle holder and the nozzle-and-holder assembly in the engine, the prescribed tightening torque must be observed and the thermal protection washer replaced in all cases. Pay attention to centrical fit.

As you know, the acoustically unpleasant engine noise can be eliminated or reduced for a short time by cleaning or replacing the injection nozzles, but this does not constitute a permanent improvement.

Numerous misunderstandings can be traced back to unawareness of the above-mentioned details and interrelationships, i.e. complaints are made and injection nozzles are rejected without justification.

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Risk of accident

Risk of accident when working with the timing-device-travel tester

When using the timing-device-travel tester on highly loaded distributor-type fuel-injection pumps of direct-injection units of the new generation (VE6/11. and 6/12..), it may arise that the plexiglass of the timing-device-travel tester cannot withstand the pressure peaks in the inner chamber of the pump (reaction on the timing-device piston) and cracks.

For this reason, when working with the timing-device-travel tester on the fuel-injection-pump test bench, build up to speeds greater than 800 min^{-1} only after completely bleeding the device!
We strongly recommend that protective goggles be worn when using this tester, until a new tester becomes available.

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BMW 524 td WITH DISTRIBUTOR-TYPE FUEL-INJECTION PUMP (0 460 406 022 (R 121)

Workshop: EP
07.1987

Complaints about "constant bucking when driving"
Replacement of the delivery-valve holder

If complaints about "constant bucking when driving" arise with regard to the vehicle mentioned above, the driveability of the vehicle may be improved by installing the flat-type pintle nozzle

0 434 250 148 (DN 0 SD 286)

in place of the flat-type pintle nozzle 0 434 250 117 (DN 0 SD 259) installed as standard.

The nozzle-opening pressure for nozzle 0 434 250 148 must be set to 150 + 8 bar. After the conversion, the holder of the nozzle-holder assembly must be marked with a yellow dot. The new nozzle is already installed in the nozzle-and-holder assembly 0 432 217 184. Replacement of the nozzles must be carried out set by set. Work must be charged to the customer.

As of FD 745 fittings (Item 58) 1 463 370 326 and ..379 used until now will be replaced by 1 463 370 380. Installation of old and new on one distributor-type fuel-injection pump is not possible, this meaning that if replacement is necessary, all 6 fittings must be replaced by the 1 463 370 380 version. The tightening torque is 45...55 Nm.

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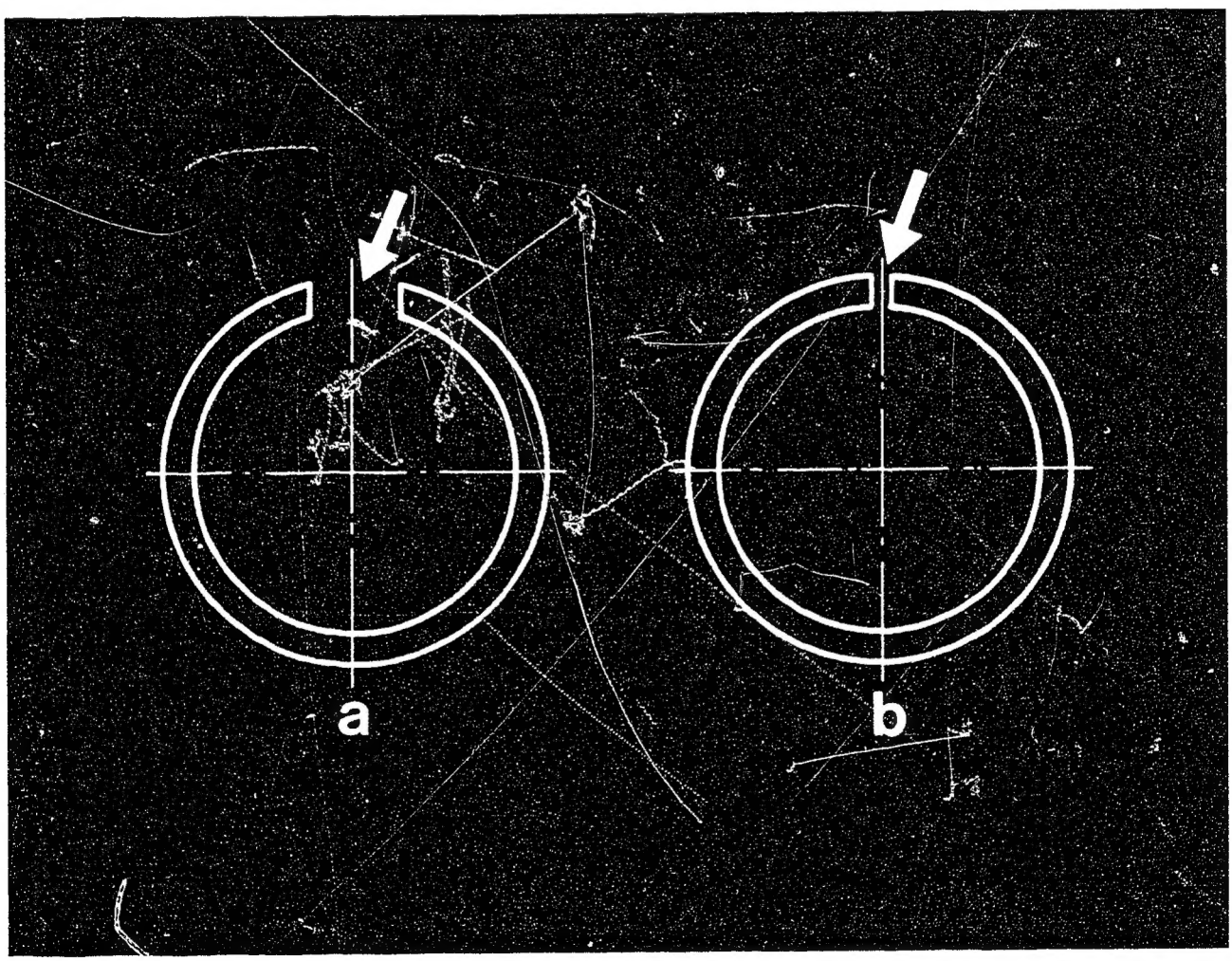
IN-LINE PUMP PE (S) .. P

Workshop: EP
07. 1987

Replacement of the retainer for the baffle cap

As of immediately, all P pumps will be equipped with the new retainer (see illustraton b).

a = previous version, slotted opening 10 mm (arrow)
b = new version, slotted opening 0 +1.5 mm (arrow)



In the case of repair, the following retainers may be used for the in-line pumps listed:

PE .. P	S 3000	
	6000	
	7000	retainer 2 414 601 008 only
	7100	
	7800	

and for

PE .. P	S 1	retainers 2 916 600 001 or
	1000	2 414 601 008

The spare-parts list for the P pumps are gradually being altered.

The existing parts sets have included since FD 650 (10.1986) only the new retainer.

Replacement of the retainer makes it necessary to also make a change to the KD tool KDEP 1046.
The altered tool can be obtained as of immediately in the usual way.
To make a distinction between it and the previous tool KDEP 1046, the new tool is marked with a FD (e.g. 02.87-> = February 1987).

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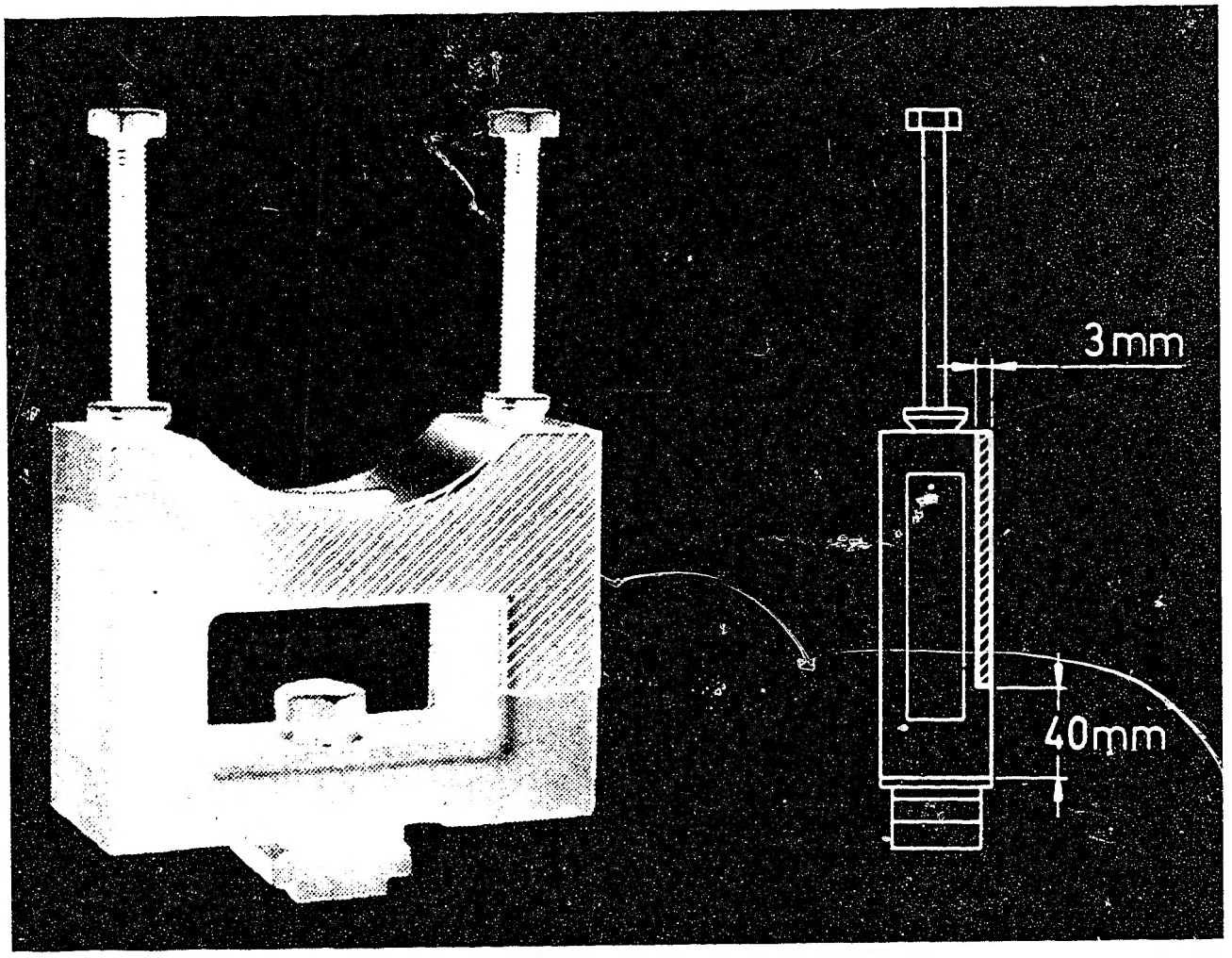
Adaptation of the clamping block 1 688 030 095

In order to be able to clamp fuel-injection pumps of size P..S 7800, rework the clamping block in accordance with the drawing.

If the clamping block cannot be reworked, order the new clamping block 1 688 030 153.

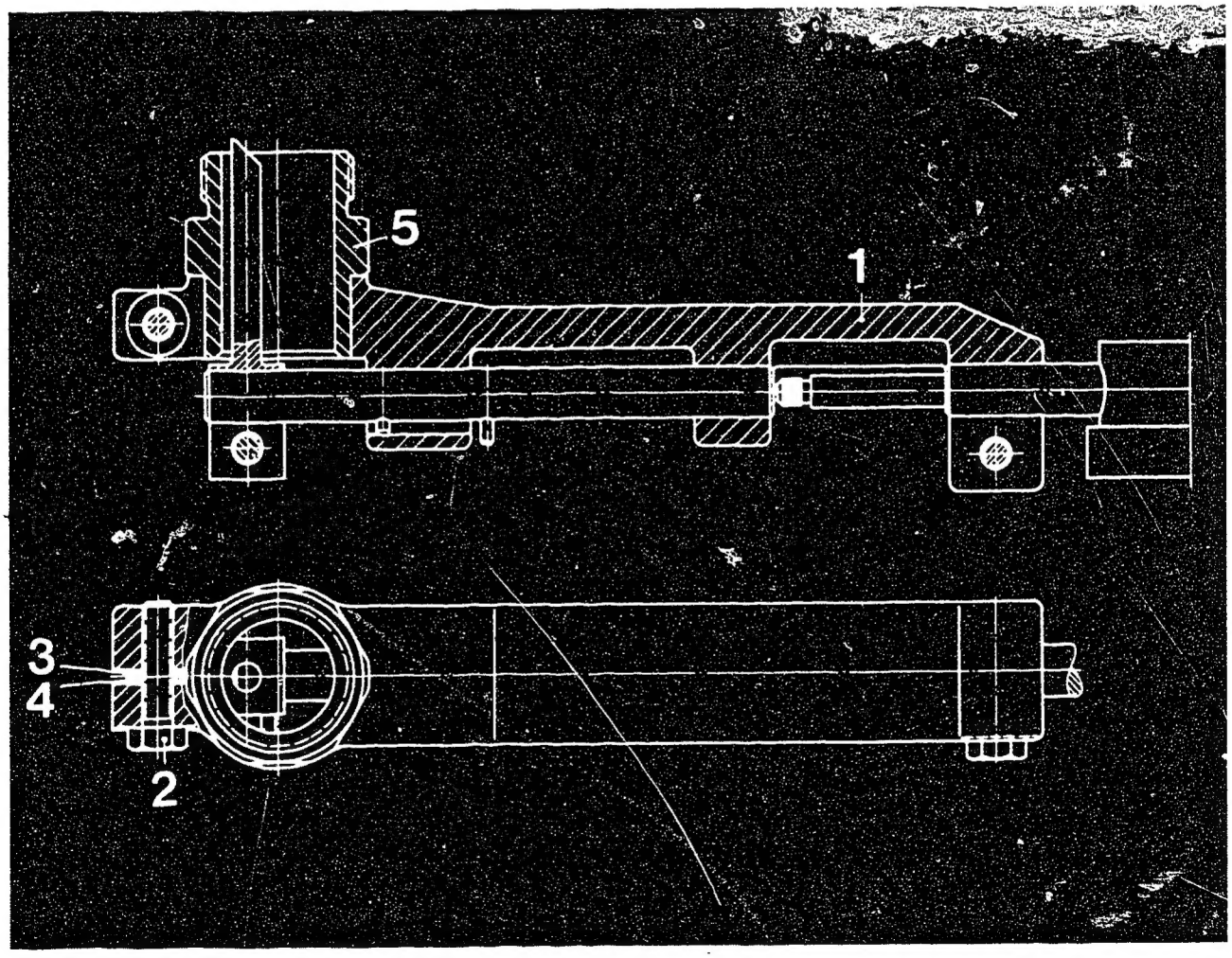


Usage of the plunger-lift-to-port-closing tester 1 688 130 085

When clamping the supporting device, you should be aware that there is a danger of the supporting device breaking at the locating ball for the tube fitting if the clamping screw is tightened too much.

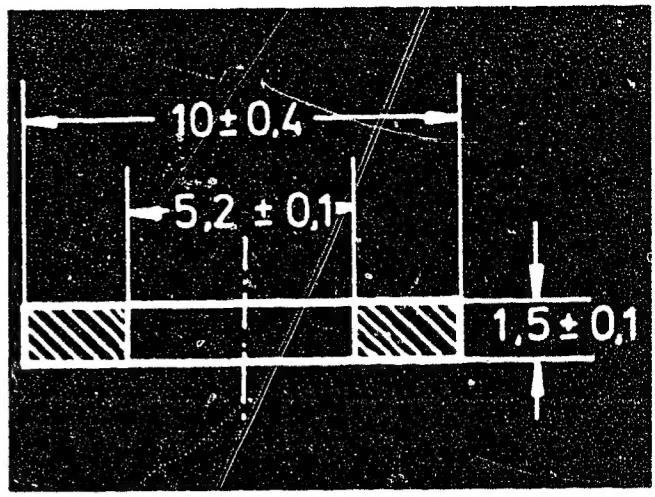
Remedy: installation of 2 shims
1 420 100 001 (Illustration, Item 3)
1 420 100 002 (Illustration, Item 4)

1 = Supporting device
2 = Clamping screw
3, 4 = Shims
5 = Tube fitting



If the shims listed are not available, they may be replaced by o n e user-manufactured shim (see illustration).

When using the plunger-lift-to-port-closing tester, make sure that 1 or 2 shim(s) are assembled.



Information for reordering:

The plunger-lift-to-port-closing tester 1 688 130 085 (without shims) is being replaced by tester 1 688 130 112 with shims.

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ADJUSTMENT DIMENSIONS FOR DISTRIBUTOR-TYPE FUEL-INJECTION PUMP VE..F..

Workshop: EP
08.1987

Please note the following with regard to the fault "manifold-pressure-compensator stroke incorrect":

The manifold-pressure-compensator stroke given in the test-specification sheet under "Dimensions" is a preset dimension for reassembly and repair of the fuel-injection pump.

When testing pumps which are the subject of complaint, the preset manifold-pressure-compensator stroke must not be applied for testing, since this preset manifold-pressure-compensator stroke is altered by the following fuel-delivery adjustment (charge-air pressure 0 bar). Testing of the manifold-pressure-compensator stroke is, therefore, not possible.

The values in brackets on the test-specification sheet apply when testing the fuel delivery.

If the actual values are outside the test tolerance, the fuel-injection pump must be readjusted and, in the case of a warranty claim, reported with the corresponding fault number.

Pumps which can no longer be adjusted must be inspected for faults and the fault causing the breakdown must be reported.

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In order to obtain more rapid bleeding and more stable pressures at the spring side of the timing device, the feed pressure is changed for adjustment and testing with the injection-pump test bench, respectively

from 0.2 +/- 0.05 bar
to 0.35 +/- 0.05 bar

The timing-device travel values and supply-pump pressure values listed in the test-specification sheet are not affected by this feed-pressure change.

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HUNTING AT HIGH IDLE

Workshop: EP
08.1987

Fiat-Allis with engine 8365.25

If complaints about "hunting at high idle" arise with regard to Fiat-Allis construction machinery with engine 8365.25 and fuel-injection pump PES 6 MW 100/270 RS 1012, the situation may be improved by installing the plunger-and-barrel assembly

1 418 415 083

in place of the plunger-and-barrel assembly 1 418 415 045 installed as standard up to FD 742 (Feb. 87).

As of FD 743 (March 87), the plunger-and-barrel assembly 1 418 415 083 is being installed as standard in the fuel-injection pump PES 6 MW 100/720 RS 1012.

Installation of old and new on one pump is not possible. Work must be charged to the customer.

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AFTER-SALES SERVICE FOR FUEL-INJECTION PUMPS
PE .. ZW (M) .. and PE .. CW ..

Workshop EP
09.1987

Replaces 06.1984 edition

Fuel-injection pumps of the CW size and certain manufacturing stages of the ZW (M) size cannot be tested on the injection-pump test benches available in after-sales service with a drive power of 11 kW.

An EPS 675 .. injection-pump test bench is needed for the testing and adjustment of these fuel-injection pumps. Two Bosch Service workshops are equipped with the appropriate test benches in the Federal Republic of Germany.

It is therefore possible to send the fuel-injection pumps for repair, testing and adjustment to the following Bosch Service workshops:

A l b e r GmbH
Bosch - Dienst
Industriestr. 17
D-7150 Backnang
Tel.: 07191/1603
Rail station: Backnang

B r u n n GmbH & Co. KG
Bosch-Dienst
Justus-von-Liebig-Str. 24
D-5300 B o n n 1
Tel.: 0228/6682-0
Rail station: Bonn-Hauptbahnhof

The fuel-injection pumps must be sent free of all charges to the Bosch Service workshops. The scope of the work to be performed must be clearly determinable from the delivery note. Except in the case of defects covered by the Robert Bosch warranty, the repair, test and adjustment work shall be carried out with the customer liable for the costs.

Handling of warranty claims

During the warranty period, in contrast with the regulation which normally applies, the fuel-injection pumps must be sent directly for warranty repair to one of the aforementioned Bosch Service workshops with warranty application G20 or G21 and delivery note KH/VKD 3-15333 with explicit reference to this Service Information.

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Depending on the way the vehicle is used and after a lengthy period of service, complaints may be received about Volvo vehicles with PE 6 P.. fuel-injection pumps because of engine-speed fluctuations at idle.

One possible cause of this is fuel-delivery dispersion as a result of cavitation on the delivery-valve cone in the region of the idling feed orifices. If this is the case an improvement can be obtained by fitting a new variant of delivery valve (see list).

The delivery valves are distinguished by the number of orifices. The previous delivery valve had 2 orifices, and the new delivery valve has 4 orifices. The delivery valves must be replaced as a set. Mixed installation of old and new is not permissible.

Cavitation damage on the delivery-valve cone does not always occur in all individual cases, meaning that replacement is only necessary if the delivery valves are damaged.

Since this modification represents a technical improvement to the fuel-injection pump, replacement of the delivery valves when necessary is not covered by warranty.

Should complaints be received during the warranty period, reimbursement of the cost of the parts is possible via a goodwill application.

The service-parts lists of the relevant fuel-injection pumps shall be changed accordingly.

Table of changes to delivery valves

1. From 2 418 554 051 to 2 418 554 063

Type of engine	Injection-pump type designation
TD 100 D	PE6P110A320 RS 3080
TD 101 F, TD 101 FA	.. RS 3080-1
TD 101 FC, TD 101 FD	.. RS 3080-2

2. From 2 418 554 043 to 2 418 554 067

Type of engine	Injection-pump type designation
TD 70 F	PE6P110A320 RS 367
TD 70 G	.. RS 367 Z
TD 70 F	.. RS 367 Y
TD 100 C	.. RS 389
TD 70 F	.. RS 413
TD 70 G	.. RS 413 Z
TD 70 F	.. RS 413 Y
TD 70 FC	.. RS 413 X
TD 70 FS	.. RS 413 W
TD 71 F	.. RS 483
TD 71 FS	.. RS 483-1
TD 71 G	.. RS 483-2
TD 71 FC	.. RS 483-3
TD 71 FD	.. RS 483-4
TD 71 FCQ	.. RS 483-5
THD 100 EA	.. RS 4108
THD 100 EB	.. RS 3108 Z
THD 100 EC	.. RS 3108 Y
THD 100 ED	.. RS 3108 X
THD 100 EE	.. RS 3108 W
THD 101 KC	.. RS 3108 V

3. From 2 418 5543 045 to 2 418 554 057

Type of engine	Injection-pump type designation
TD 120 F	PE6P120A320 RS 3050
TD 120 FC	.. RS 3050 Z
TD 120 F	.. RS 3074
TD 121 F	.. RS 3118
TD 121 FA, FB	.. RS 3118-1
TD 121 FC	.. RS 3118-2
TD 121 FE	.. RS 3118-3
TD 121 FF, TD 121 FG	.. RS 3118-4
TD 121 FH	.. RS 3118-5

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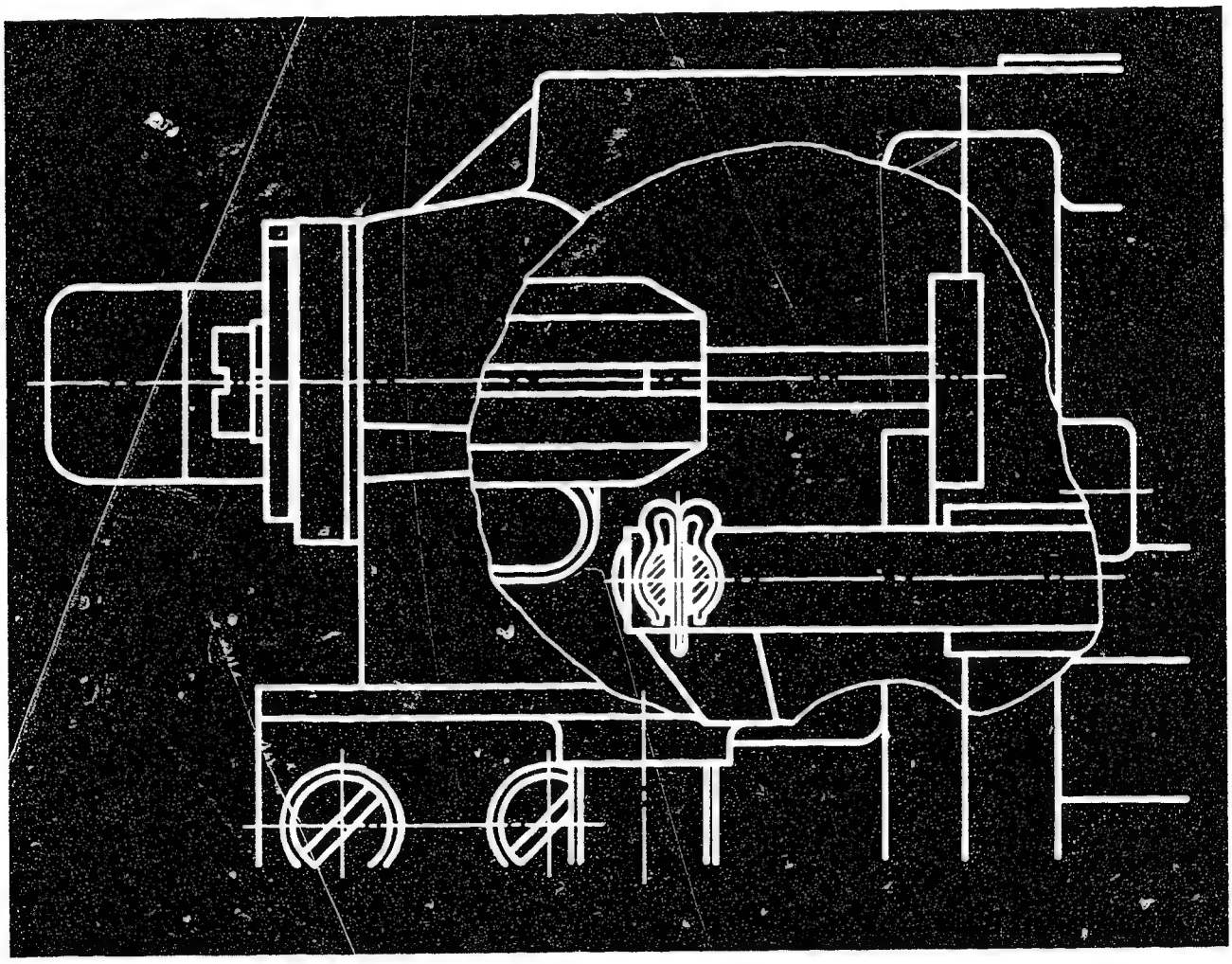
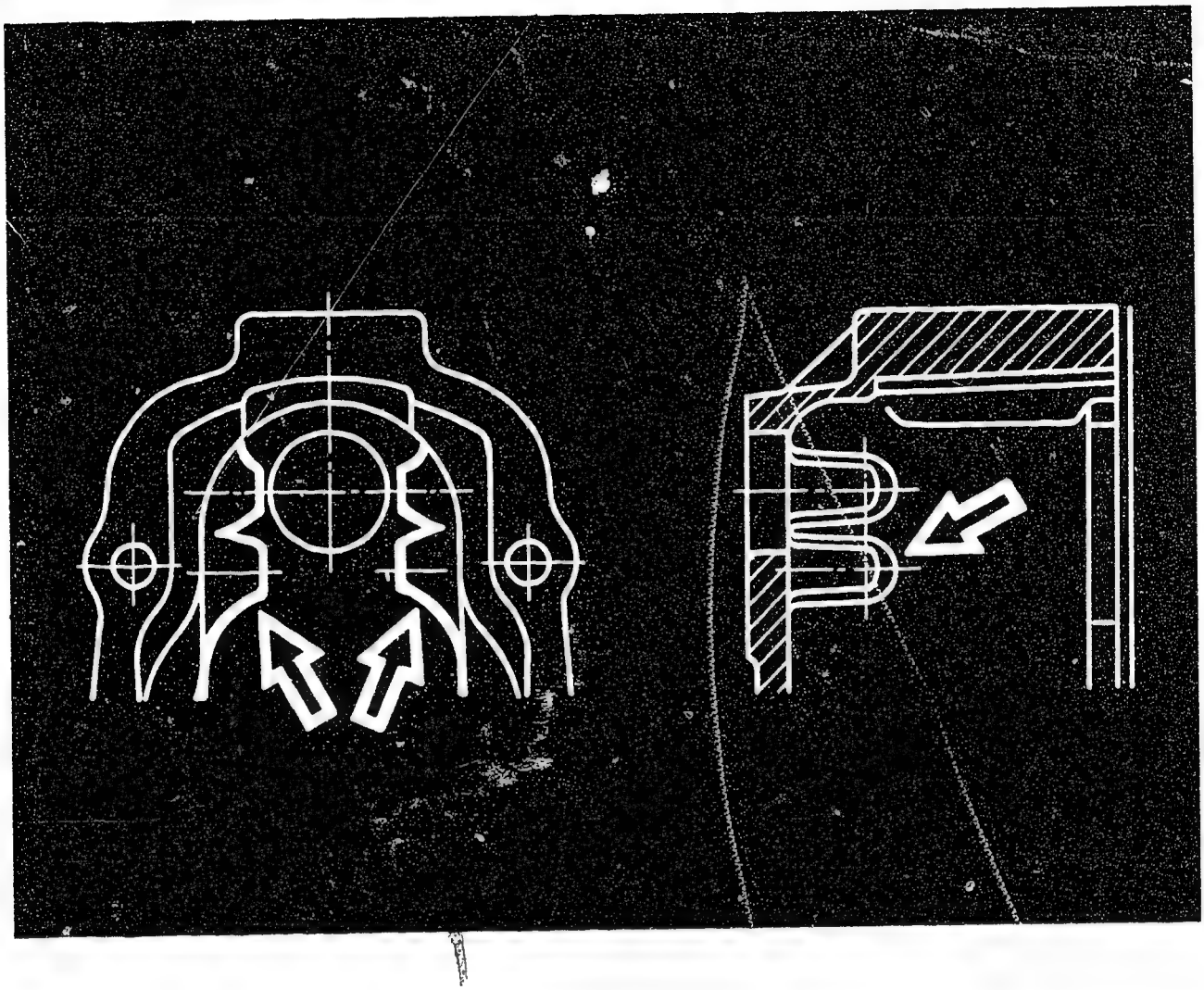
RQ .. AB 1137 .. GOVERNOR

Workshop: EP

Fitting of wire split pin instead of spring split pin

The PES..A.. injection-pump assembly with RQ..AB 1137 to ..1137-11 governor is fitted in MAN engines.
In assemblies from FD 447 onwards, it may happen that the spring split pin (Item 24, arrow) comes into contact with the lower boss of the governor cover during overrun (Fig. 1). This affects only vertically mounted fuel-injection pumps and not those mounted horizontally.





In order to prevent this, in the event of repair when governor covers have lower bosses (Fig. 2), the holding pin (Item 28) is n o t to be secured with a spring split pin but with a wire split pin 1 904 681 170.

As of FD 747 (7.87), there is no lower boss on the governor cover. The holding pin on these governor covers is to be secured with a spring split pin.

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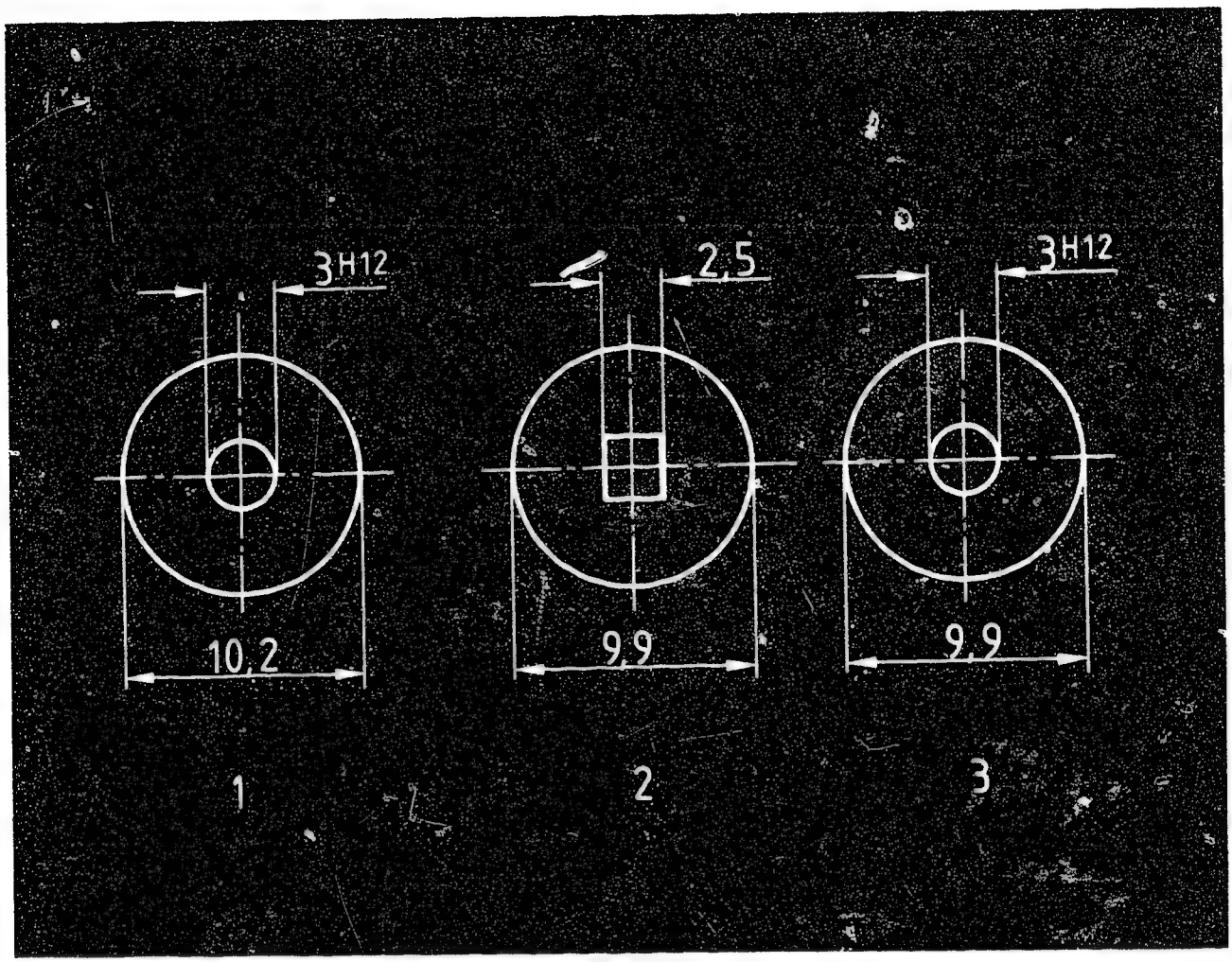
2. Alteration of the adjusting shims

The spring guide has been improved in the KDEL, KBEL, KBELZ nozzle-holder assemblies size P and KDEL, KBE and KBEL size S with 21 mm shank diameter (standard switch).

As a result of a change to the diameter of the spring guide from 10.4 mm to 10.2 mm, the diameter of the adjusting shims is also changed from 10.2 mm to 9.9 mm.

The new adjusting shims were identified by a square hole. For technical production reasons, the new adjusting shims are delivered from the end of 1986 onwards with a round central cutout only.

Adjusting shims with a round central cutout delivered after the end of 1986 conform with the latest state of the art and have an external diameter of 9.9 mm.



1 = Old adjusting shim 2 430 100 900 to .. 949
2 = New adjusting shim 2 430 101 170 to .. 219
3 = Modified new adjusting shim 2 430 101 170
to .. 219

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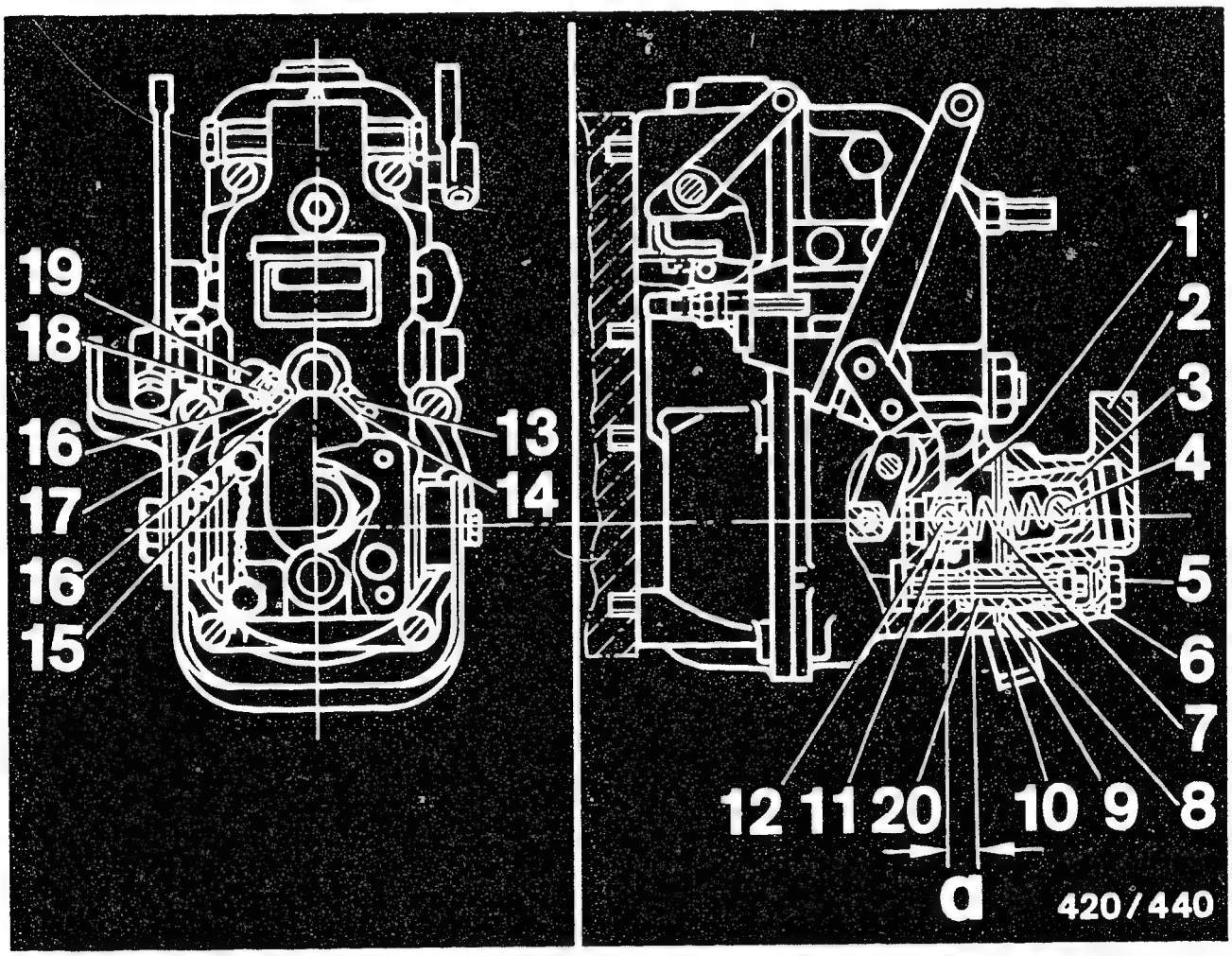
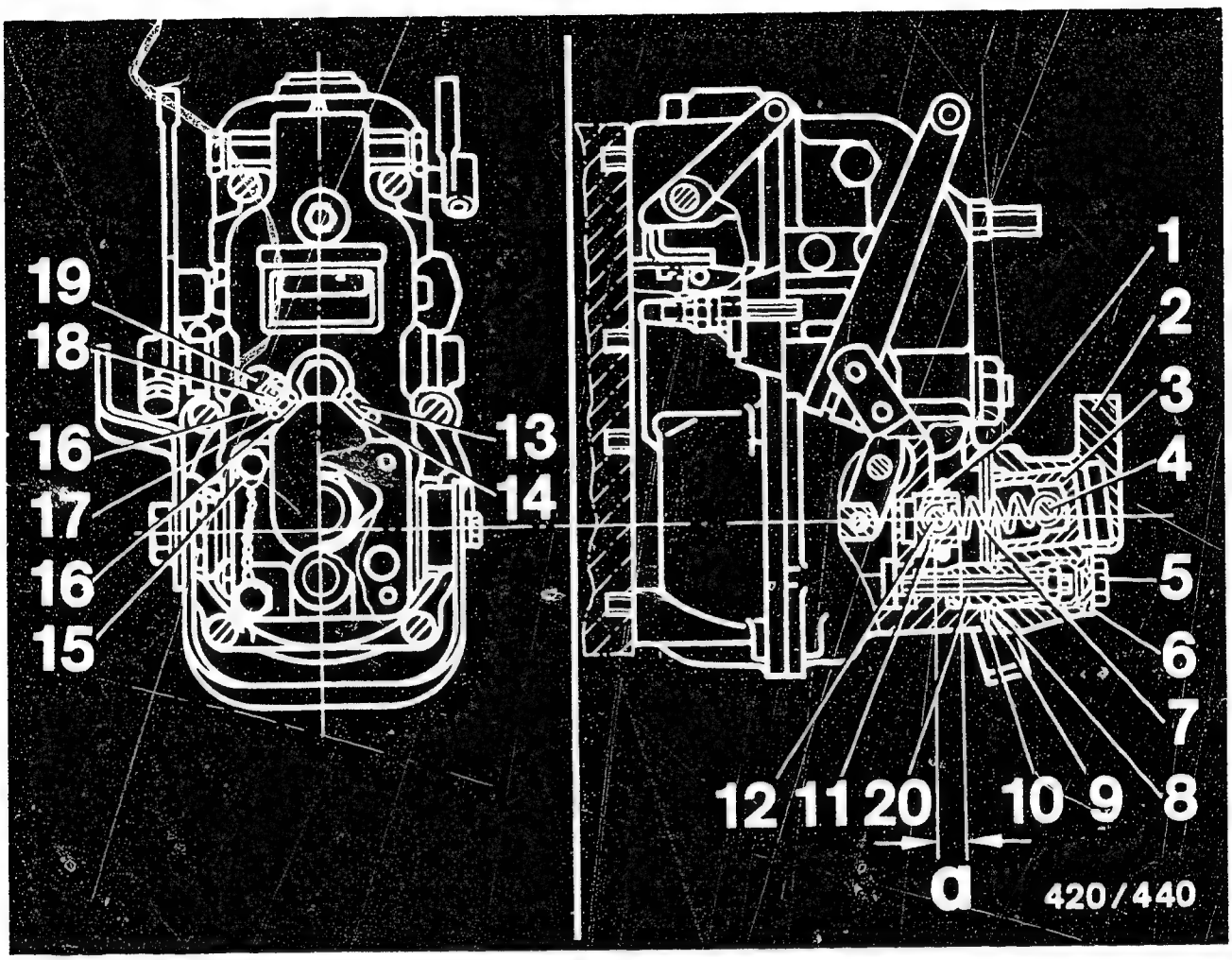
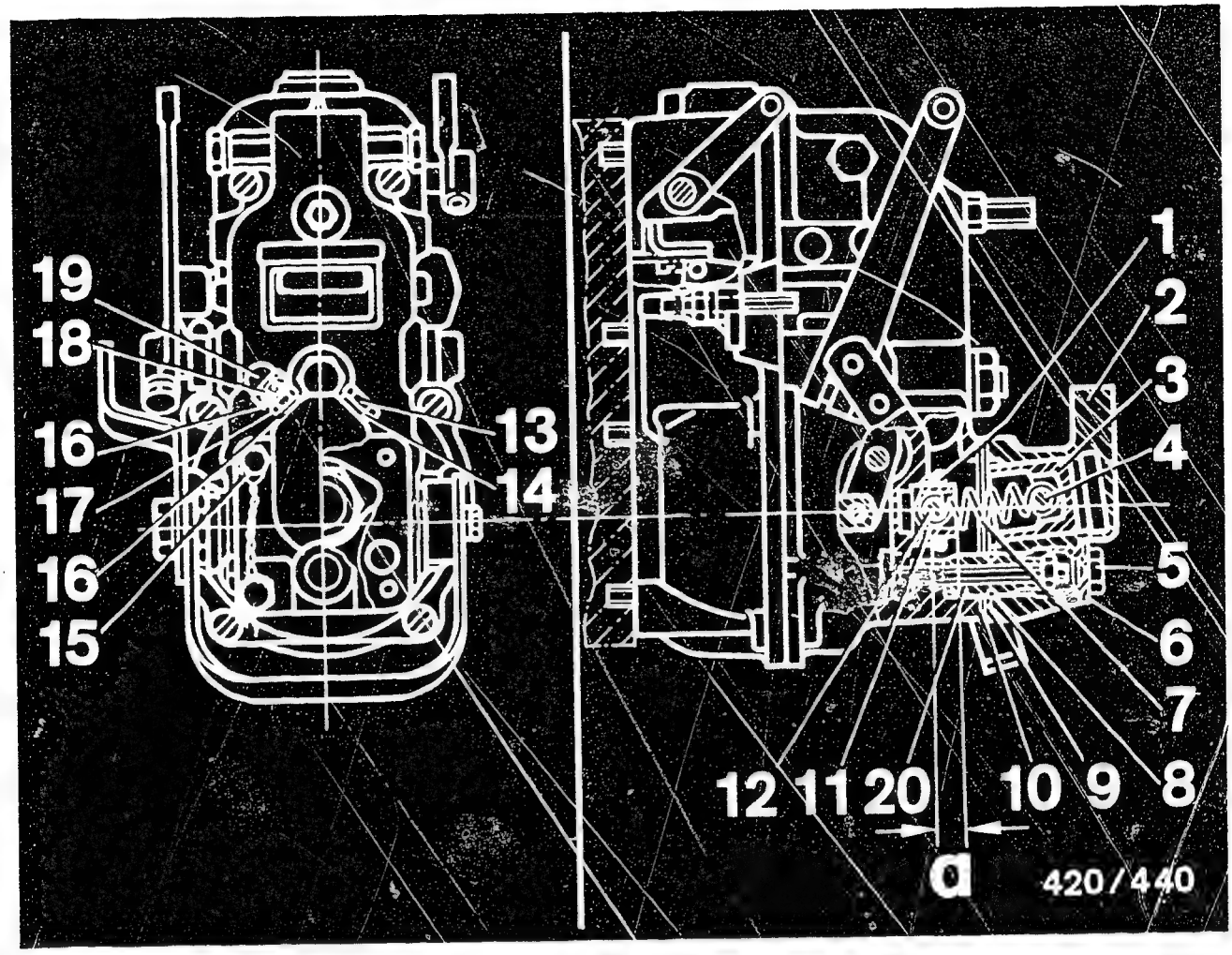
Notes on assembly and testing
of stabilizer

1 = Lock nut
2 = Stabilizer housing
3 = Stabilizer piston
4 = Bolt
5 = Screw plug
6 = Seal ring
7 = Stabilizer spring
8 = O-ring
9 = Gasket
10 = Partition plate
11 = Threaded bushing
12 = Bolt
13 = Screw plug
14 = Seal ring



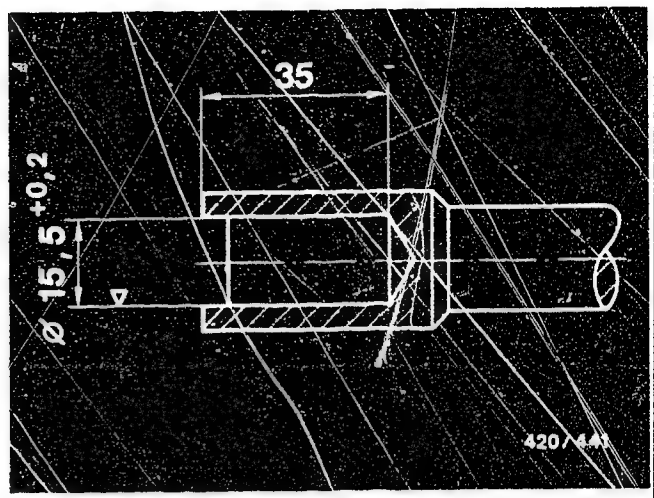


15 = Fastening screw
16 = Seal ring
17 = Lock nut
18 = Throttle screw
19 = Cap nut
20 = Guide bushing
a = Projection



Assembly
Requirement:
Complete injection-pump unit without stabilizer mounted is clamped on to the injection-pump test bench and the sleeve position of the governor is adjusted (SIS micro-card W-420/310 Coord. C04).
Assemble threaded bushing (Item 11), bolt (Item 12), spring (Item 7) and lock nut (Item 1) as one assembly and screw into the tensioning lever of the governor into the tapped hole in which the torque-control spring retainer is usuallly located. Make sure that the lugs of the stabilizer spring are aligned precisely with the longitudinal axis of the tensioning lever.
The projection "a" of the threaded bushing when screwed in is 7.0...8.0 Nm.

For screwing in and tightening the complete assembly, use the socket wrench KDEP 2966 with modification (see illustration) and the lock nut to 30...35 Nm.



After testing the spring attachment for freedom of movement, moisten the stabilizer piston (Item 3) with lubricating oil and hook into the spring lug using bolt (Item 4) (spring lug must latch into groove in bolt.
Check stabilizer piston for freedom of movement and straight positioning.

Position partition plate (Item 10) and gasket (Item 9) on to the sealing surface of the governor cover.
Moisten O-ring (Item 8) with oil and tallow mixture 5 963 340 110 and pull on to guide bushing (Item 20).
Mount stabilizer housing (Item 2) and tighten with fastening screws (Item 15) on to governor housing.
Specified tightening torque: 6...8 Nm.

Testing

After removing the cap nut (Item 19), open the throttle screw (Item 18) by approx. 4...5 rotations. Remove screw plug (Item 13). Screw hose fitting of the test hose KDEP 1618 into the tapped hole. The hose must be laid vertically.

Top up the governor with lubricating oil until the oil level is visible at the transparent test hose KDEP 1618.
Position control lever to maximum stop and secure in this position.

Switch on test bench and run the injection-pump assembly at speed specified for setting the full-load delivery.

Increase the engine speed until the governor has fully regulated and reduce speed again down to the initial speed. Repeat this procedure (increasing and reducing the engine speed) four to five times.

When the engine speed is increased, the oil level in the test hose KDEP 1618 must rise each time and the level must drop accordingly when the engine speed is reduced. If this is not the case, check whether the stabilizer piston (Item 3) can move freely or whether the setting of the throttle screw (Item 18) is correct and, if necessary, adjust accordingly.
After successfully checking the operation of the stabilizer, switch off the test bench. Close throttle screw as far as it will go and unscrew again by one rotation.

Tighten lock nut (Item 17).
Position seal ring (Item 16) and tighten cap nut (Item 19).
Unscrew the test hose KDEP 1618 from the stabilizer housing and screw the screw plug with seal ring (Item 13 and Item 14) into the stabilizer housing and tighten.

Continue adjustment of governor in accordance with test instructions (SIS microcard W-420/310).

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Test specifications for in-line pumps with governors

For reasons concerned with computer programming, the angle details given in test specifications for adjusting the sleeve position must be presented in an encoded manner.

This is necessary, since the computer is capable of processing only numerical values.

The following values have now been introduced for the control-lever stop:

Data

-1 = maximum control-lever deflection

-2 = maximum of 46° control-lever deflection

-3 = control lever loose.

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ADJUSTMENT OF DELIVERY ON IN-LINE PUMPS OF SIZE P MOUNTED ON SCANIA ENGINES

Workshop: EP
11.1987

The old Technical Bulletin VDT-I-400/116 (06.1986) must be sorted out and discarded.

On in-line pumps of size P which are mounted on engines of the D8, DN8, DS8, DSI8, DS9, DSC9, DN11, DS11, DSI11, DSC11, DS14, DSC14, and DSI14 series, Scania resets the full-load deliveries for higher or lower levels of power.

The pumps are identified by an additional letter after the type designation of the pump and sometimes after the part number of the assembly. A reference to this Technical Bulletin is included with the appropriate test specifications in the case of exchange.

For the D11 engine, the delivery settings are listed on the test-specification sheet SCA11,On. (See in each case the latest edition on microcard WP-..).

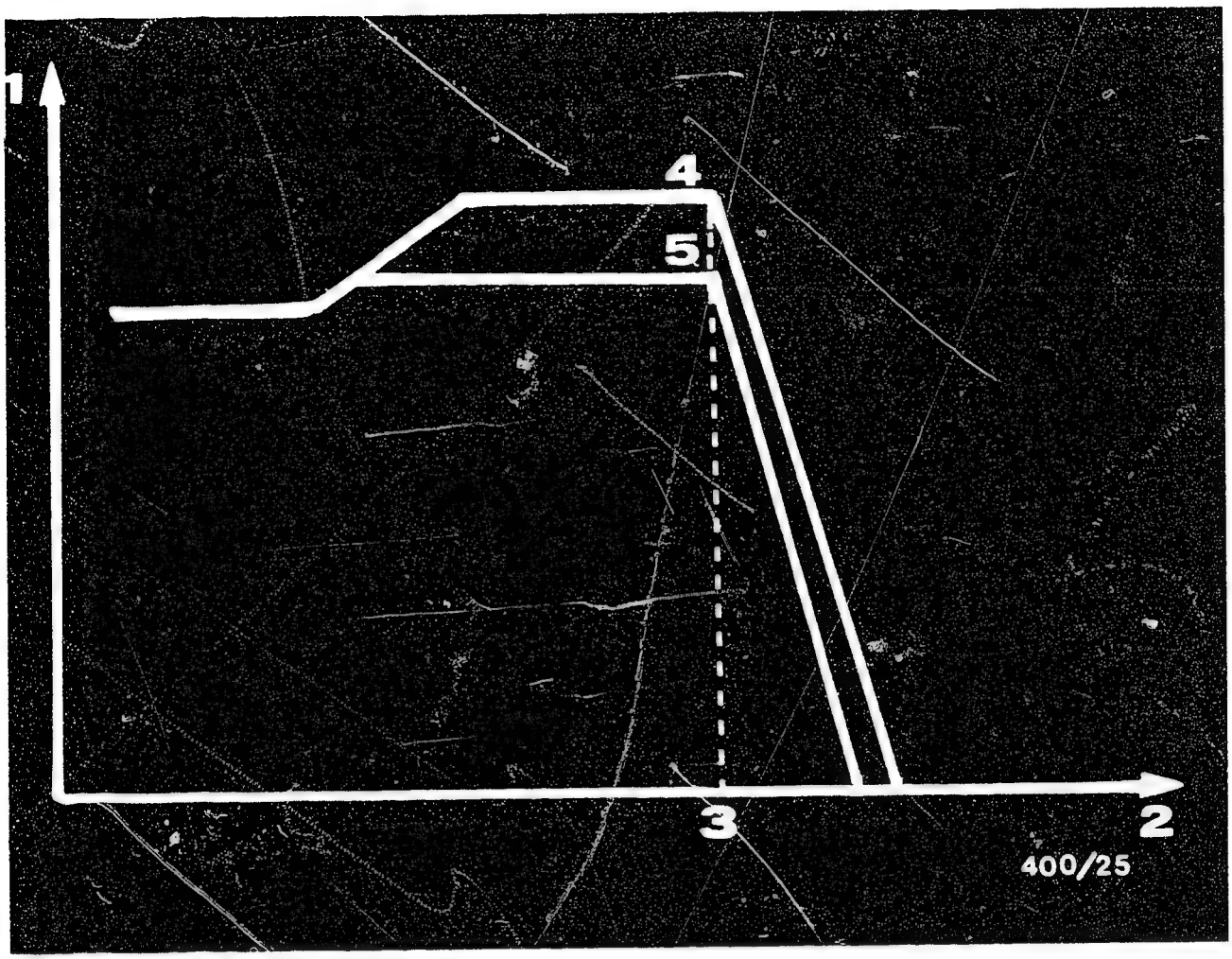
N o t e :

The injection-pump assemblies may be adjusted only in accordance with the pump designation and identification.

Use only the most recent valid test specifications on microcard WP... . Other injected fuel quantities may lead to engine damage and thus to claims for compensation by the engine/vehicle owners.

In the case of replacement orders of complete injection-pump assemblies, only the assembly with the basic adjustment is supplied; this means that whenever a marked (identification) injection pump is replaced, the fuel delivery must be adjusted and the pump marked with its identification accordingly.

For readjusting, always use the test specifications for the basic assembly without suffixed letters, if there is no separate test-specification sheet available. Afterwards, the necessary correction to the full-load delivery should be performed.



1 = Control-rod travel (mm)
2 = Engine speeds n (min-1)
3 = Maximum rated speed
4 = Full-load control-rod travel with charge-air pressure
5 = Full-load control-rod travel without charge-air pressure

If due to the reduction of delivery, the full-load control-rod travel (4) becomes smaller than the full-load control-rod travel (5), adjustment of the manifold-pressure compensator (LDA) is no longer necessary.
The fuel deliveries given in the tables have been compiled in accordance with Saab-Scania documentation.

Engine	Pump	Governor
D8	PE 6 P 110 A 720 RS 261	RQV..170R, EP/RSV..310 R
Assy. No. 0 401 846 364 / 0 401 876 175		

Pump S261..	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1 1200	900	750	600	Control-rod-travel change on full-load adjustment
X	84	81	78	72	- 0.7 mm
Z	80	75	71	64	- 1.2 mm
N	76	70	64	55	- 1.7 mm
M	71	63	57	47	- 2.3 mm
L	66	57	52	43	- 2.8 mm
K	60	52	46	37	- 3.3 mm
J	56	49	44	34	- 3.6 mm
I	51	46	41	31	- 3.9 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DN8	PE 6 P 110 A 720 RS 393	RQV200/1200 PA 224 RQV250/1200 PA 469 RQ 750 PA 528 RQ 900 PA 528 RSV833 110
Assy. No. 0 401 846 423, ..424, ..479, ..480 0 401 876 240		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1			Control-rod-travel change on full-load adjustment
	600	700	850	
S	83	87	92	- 0.3 mm
X	77	81	87	- 0.6 mm
Q	73	78	84	- 0,9 mm
Z	67	74	80	- 1.2 mm
O	64	71	78	- 1.4 mm
N	60	67	75	- 1.7 mm
M	55	62	70	- 2.1 mm
L	50	57	65	- 2.6 mm
K	46	52	60	- 3.0 mm
J	42	48	56	- 3.4 mm
I	38	45	51	- 3.8 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS8	PE 6 P 110 A 720 RS 3012 PE 6 P 110 A 720 RS 3013 PE 6 P 110 A 720 RS 3034 PE 6 P 110 A 720 RS 3035	RQV..275R EP/RSV..310R RQV .. 275 R EP/RSV..310 R

Assy. No. 0 401 846 705
0 401 876 703, ..708, ..709

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Control-rod-travel change on full-load adjustment
	1200	900	750	600	
T	121	118	118	118	+ 0.3 mm
S	113	109	108	107	- 0.2 mm
X	109	105	102	101	- 0.5 mm
Q	106	102	99	97	- 0.7 mm
Z	102	98	94	91	- 1.0 mm
O	100	95	91	86	- 1.2 mm
N	96	92	87	80	- 1.5 mm
M	91	86	80	69	- 1.9 mm
L	86	81	74	60	- 2.3 mm
K	80	74	66	51	- 2.8 mm
J	77	71	63	46	- 3.1 mm
I	73	67	58	41	- 3.5 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS8 05,06	PE 6 P 110 A 720 RS 3034	RQV 200–1200 PA 554
40		RQV 200–1200 PA 554
DS8 05 Crane	PE 6 P 110 A 720 RS 3034 Z	RQV 275–1200 PA 554–1
		RQV 200–1100 PA 657–4
		RSUV 833110
Assy. No. 0 401 876 715		RSV
0 401 846 733, ..770, ..790		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	117	– 0.2 mm
X	110	– 0.5 mm
Q	106	– 0.7 mm
Z	102	– 1.0 mm
O	98	– 1.2 mm
N	93	– 1.5 mm
M	85	– 1.9 mm
L	78	– 2.4 mm
K	72	– 2.8 mm
J	66	– 3.2 mm
I	60	– 3.6 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS 8 42	PE 6 P 110 A 720 RS 3076	RQ 750 PA 528 RQ 900 PA 528
Assy. No. 0 401 846 775, ..776		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1		Control-rod-travel change on full-load adjustment
	700	850	
Y	129	131	+ 0.5 mm
T	125	127	+ 0.3 mm
S	114	118	- 0.2 mm
X	107	112	- 0.5 mm
Q	103	108	- 0.8 mm
Z	96	103	- 1.1 mm
O	93	100	- 1.3 mm
N	88	96	- 1.5 mm
M	81	89	- 2.0 mm
L	75	83	- 2.4 mm
K	69	78	- 2.8 mm
J	63	71	- 2.3 mm
I	56	65	- 3.7 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DSI8 01	PE 6 P 110 A 720 RS 3034	RQV 200–1200 PA 520
DSI8 01 Crane		RQV 275–1200 PA 529–1
Assy. No. 0 401 846 732, ..791		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	126	– 0.2 mm
X	120	– 0.5 mm
Q	115	– 0.7 mm
Z	108	– 1.0 mm
O	104	– 1.2 mm
N	99	– 1.5 mm
M	90	– 2.0 mm
L	82	– 2.5 mm
K	75	– 2.9 mm
J	69	– 3.4 mm
I	63	– 3.8 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DSI 8 41	PE 6 P 110 A 720 RS 3076	RQ 750 PA 528 – 1 RQ 900 PA 528 – 2
Assy. No. 0 401 846 777, ..778		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1		Control–rod–travel change on full–load adjustment
	700	850	
S	129	131	– 0.2 mm
X	123	125	– 0.5 mm
Q	119	121	– 0.7 mm
Z	112	116	– 1.0 mm
O	106	111	– 1.3 mm
N	100	106	– 1.6 mm
M	92	99	– 2.0 mm
L	83	92	– 2.5 mm
K	76	85	– 3.0 mm
J	71	79	– 3.4 mm
I	65	73	– 3.8 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS9 01	PE 6 P 120 A 320 RS 7102	RQV 200–1100 PA 712–1
03	PE 6 P 120 A 320 RS 7102	RQV 200–1100 PA 712
	PE 6 P 120 A 320 RS 7102	RQ 200/1000 PA 745

Assy. No. 0 402 746 800,
0 402 646 822, ..833

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	160	– 0.1 mm
X	154	– 0.4 mm
Q	151	– 0.6 mm
Z	145	– 0.9 mm
O	140	– 1.1 mm
N	134	– 1.4 mm
M	126	– 1.9 mm
L	119	– 2.3 mm
K	112	– 2.7 mm
J	107	– 3.0 mm
I	102	– 3.3 mm
H	96	– 3.6 mm
G	91	– 3.8 mm

The test specifications apply for calibration oil ISO – 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DC9	PE 6 P 120 A 320 RS 7103	RQV 200–1100 712
Assy. No. 0 402 746 801		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	174	– 0.4 mm
X	168	– 0.9 mm
Q	164	– 1.2 mm
Z	158	– 1.6 mm
O	154	– 1.9 mm
N	146	– 2.4 mm
M	135	– 3.1 mm
L	126	– 3.7 mm
K	118	– 4.1 mm
J	112	– 4.4 mm
I	105	– 4.7 mm
H	99	– 5.0 mm
G	93	– 5.3 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DN11 01 04	PE 6 P 120 A 720 RS 3065	RQV 250–1100 PA 468 RQ 250/1100 PA 470 RSV 350–1100 P1/481
Assy. No. 0 401 846 721, ..722, ..722 X 876 719		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	132	– 0.2 mm
X	126	– 0.5 mm
Q	122	– 0,7 mm
Z	117	– 1.0 mm
O	114	– 1.2 mm
N	111	– 1.4 mm
M	106	– 1.7 mm
L	99	– 2.1 mm
K	94	– 2.5 mm
J	89	– 2.8 mm
I	83	– 3.3 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DN11 01	PE 6 P 110 A 720 RS 3115	RQV 200–1100 PA 468 RQ 290/1100 PA 719 RSV 350–1100 P1/481
Assy. No. 0 401 846 764, ..800 0 401 876 728		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control-rod-travel change on full-load adjustment
	600	
S	113	– 0.3 mm
X	106	– 0.6 mm
Q	101	– 0.8 mm
Z	94	– 1.1 mm
O	91	– 1.3 mm
N	84	– 1.6 mm
M	75	– 2.0 mm
L	65	– 2.5 mm
K	58	– 2.9 mm
J	50	– 3.3 mm
I	45	– 3.7 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DN11 06 07	PE 6 P 120 A 720 RS 7001	RQV 200–1100 PA 612 RQ 200/1000 PA 615
Assy. No. 0 402 646 807, ..808		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control–rod–travel change on full–load adjustment
	600	
S	152	– 0.2 mm
X	141	– 0.6 mm
Q	137	– 0.8 mm
Z	130	– 1.1 mm
O	128	– 1.2 mm
N	122	– 1.5 mm
M	117	– 1.8 mm
L	109	– 2.2 mm
K	105	– 2.5 mm
J	102	– 2.8 mm
I	98	– 3.1 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 680 750 015.

Engine	Pump	Governor
DN 11 40	PE 6 P 120 A 720 RS 7004	RQ 750 PA 528 – 2 RQ 900 PA 528 – 2
Assy. No. 0 402 646 815, .. 814		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1		Control–rod–travel change on full–load adjustment
	700	850	
S	152	159	– 0.2 mm
X	147	155	– 0.5 mm
Q	144	152	– 0.6 mm
Z	139	147	– 0.9 mm
O	136	143	– 1.1 mm
N	130	138	– 1.3 mm
M	123	130	– 1.7 mm
L	116	122	– 2.1 mm
K	109	116	– 2.4 mm
J	103	109	– 2.7 mm
I	98	103	– 3.0 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 11	PE 6 P 110 A 720 RS 3006	RQV .. 242 R
	PE 6 P 110 A 720 RS 3016	EP/RSV.. 310 R
	PE 6 P 110 A 720 RS 3014	EP/RSV.. 310 R
Assy. No. 0 401 846 703		
0 401 876 702, ..704		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Control-rod-travel change on full-load adjustment
	1100	900	750	600	
P	198	202	202	204	+ 2.1 mm
U	188	189	188	192	+ 1.6 mm
R	183	185	184	187	+ 1.4 mm
W	178	178	178	181	+ 1.0 mm
V	175	175	174	177	+ 0.8 mm (Case-USA)
Y	170	170	169	171	+ 0.5 mm
T	168	167	166	167	+ 0.3 mm
S	158	159	158	159	- 0.2 mm
X	152	154	153	154	- 0.4 mm
Q	148	151	150	150	- 0.6 mm
Z	143	146	146	146	- 0.8 mm
O	139	142	142	142	- 1.0 mm
N	133	134	136	135	- 1.3 mm
M	124	125	127	126	- 1.7 mm
L	116	115	117	114	- 2.1 mm
K	108	106	105	102	- 2.5 mm
J	101	97	96	92	- 2.9 mm
I	94	90	88	85	- 3.4 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS 11	PE 6 P 100 A 720 RS 202 PE 6 P 100 A 720 RS 203	RQV .. 167 R, 168 R EP/RSV.. 310 R
Assy. No.	0 401 846 233, ..234, ..240 0 401 876 126, ..134	

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Control-rod-travel change on full-load adjustment
	1100	900	750	600	
W*	176	179	181	182	+ 0.9 mm
V*	172	174	176	176	+ 0.7 mm
Y*	168	170	172	171	+ 0.5 mm
T	165	166	168	164	+ 0.3 mm
S	156	157	157	152	- 0.2 mm
X	151	152	152	147	- 0.5 mm
Q	147	148	148	143	- 0.7 mm
Z	142	143	142	137	- 1.0 mm
O	138	139	137	133	- 1.2 mm
N	133	135	132	127	- 1.6 mm
M	124	125	122	116	- 2.1 mm
L	114	115	111	104	- 2.7 mm
K	104	105	100	93	- 3.2 mm
J	97	96	90	83	- 3.7 mm
I	89	86	80	73	- 4.3 mm

* Start of delivery with these variants at prestroke = 2.4...2.5 mm from BDC

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS11 01	PE 6 P 110 A 720 RS 3040	RQV 250–1100 PA 379 R RQ 250/1100 PA 411 R
DS11 11		RQV 200–1050 PA 379

Assy. No. 0 401 846 710, ..717, ..724

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 600	Control-rod-travel change on full-load adjustment
T	171	+ 0.4 mm
S	158	– 0.2 mm
X	153	– 0.5 mm
Q	150	– 0.6 mm
Z	144	– 0.9 mm
O	140	– 1.1 mm
N	132	– 1.5 mm
M	119	– 2.0 mm
L	107	– 2.5 mm
K	96	– 2.9 mm
J	86	– 3.3 mm
O	78	– 3.7 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS11 05 Assy. No. 0 401 876 720	PE 6 P 110 A 720 RS 3040	RSV 350-1100 P1/481

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1 1100	Control-rod-travel change on full-load adjustment
S	153	- 0.2 mm
X	147	- 0.5 mm
Q	140	- 0.8 mm
Z	134	- 1.1 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS11 05 Case Assy. No. 0 401 876 734	PE 6 P 110 A 720 RS 3040-1	RSV 350-1100 P1/505

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1 1100	Control-rod-travel change on full-load adjustment
S	153	- 0.2 mm
X	147	- 0.5 mm
Q	140	- 0.8 mm
Z	134	- 1.1 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS11 14	PE 6 P 110 A 720 RS 3040	RQV 200–1000 PA 555
Assy. No. 0 401 846 734		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 600	Control–rod–travel change on full–load adjustment
S	170	– 0.3 mm
X	162	– 0.7 mm
Q	158	– 0.9 mm
Z	153	– 1.2 mm
O	150	– 1.3 mm
N	144	– 1.6 mm
M	132	– 2.2 mm
L	119	– 2.7 mm
K	107	– 3.2 mm
J	96	– 3.6 mm
I	86	– 4.0 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS11 14 DS11 14 – Crane	PE 6 P 110 A 720 RS 3040	RQV 200–1000 PA 555–1 RQV 275–1000 PA 555–2
Assy. No. 0 401 846 763, .. 795		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control–rod–travel change on full–load adjustment
	700	
S	164	– 0.2 mm
X	158	– 0.5 mm
Q	154	– 0.7 mm
Z	148	– 1.0 mm
O	143	– 1.2 mm
N	137	– 1.5 mm
M	128	– 2.0 mm
L	118	– 2.5 mm
K	108	– 2.9 mm
J	99	– 3.4 mm
I	89	– 3.8 mm

The test specifications apply for calibrating oil to ISO – 4113

Engine	Pump	Governor
DS11 15, 18	PE 6 P 120 A 720 RS 7001	RQV 200–1000 PA 539 RQV 200–1050 PA 539 RQV 200/1000 PA 616
DS11 15 – Crane		RQV 275–1000 PA 539–4
Assy. No. 0 402 646 801, ..802, ..809 0 402 646 817		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	195	– 0.2 mm
X	185	– 0.6 mm
Q	180	– 0.8 mm
Z	173	– 1.1 mm
O	169	– 1.3 mm
N	162	– 1.6 mm
M	153	– 2.0 mm
L	143	– 2.5 mm
K	135	– 2.9 mm
J	126	– 3.4 mm
I	119	– 3.8 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS11 25, 26 28, 33 Assy. No. 0 402 646 819	PE 6 P 120 A 720 RS 7001	RQV 200/1100 PA 713

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1 700	Control-rod-travel change on full-load adjustment
W	181	+ 0.9 mm
V	177	+ 0.7 mm
Y	171	+ 0.5 mm
T	167	+ 0.3 mm
S	159	- 0.1 mm
X	153	- 0.4 mm
Q	149	- 0.5 mm
Z	144	- 0.8 mm
O	141	- 0.9 mm
N	136	- 1.1 mm
M	129	- 1.5 mm
L	122	- 1.9 mm
K	116	- 2.3 mm
J	110	- 2.6 mm
I	104	- 3.0 mm
H	98	- 3.4 mm
G	93	- 3.7 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DS11 40, 41, 42 DSI11 40, 44 Assy. No. 0 402 676 800	PE 6 P 120 A 720 RS 7001	RQV 350–1100 P 1/481

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control–rod–travel change on full–load adjustment
	700	
U	242	+ 1.9 mm
R	235	+ 1.6 mm
W	228	+ 1.3 mm
V	221	+ 1.0 mm
Y	215	+ 0.7 mm
T	208	+ 0.4 mm
S	195	– 0.2 mm
X	185	– 0.6 mm
Q	180	– 0.8 mm
Z	173	– 1.1 mm
O	169	– 1.3 mm
N	162	– 1.6 mm
M	153	– 2.0 mm
L	143	– 2.5 mm
K	135	– 2.9 mm
J	126	– 3.4 mm
I	119	– 3.8 mm

The test specifications apply for calibration oil ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 11 43, 44 45 DSI 11 42, 45 Assy. No. 0 402 646 803, ..804, ..805	PE 6 P 120 A 720 RS 7004	RQ 750 PA 528 RQ 900 PA 528 RQ 1050 PA 528

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1			Control-rod-travel change on full-load adjustment
	700	850	1000	
U	257	264	264	+ 2.1 mm
R	251	255	255	+ 1.8 mm
W	240	241	242	+ 1.3 mm
V	233	231	234	+ 1.0 mm
Y	224	221	226	+ 0.6 mm
T	217	215	221	+ 0.3 mm
S	204	206	211	- 0.2 mm
X	197	199	206	- 0.5 mm
Q	192	194	202	- 0.7 mm
Z	184	189	197	- 1.0 mm
O	179	184	193	- 1.2 mm
N	171	178	187	- 1.5 mm
M	159	168	176	- 2.0 mm
L	152	160	168	- 2.4 mm
K	142	150	157	- 2.9 mm
J	134	142	148	- 3.3 mm
I	127	134	139	- 3.7 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DSC11 01 01 – Crane 02 Assy. No. 0 402 646 812, ..818	PE 6 P 120 A 720 RS 7007	RQV 200–1000 PA 539–2 RQV 275–1100 PA 539–5

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
Y	226	+ 1.3 mm
T	220	+ 0.8 mm
S	205	– 0.4 mm
X	196	– 1.1 mm
Q	191	– 1.6 mm
Z	183	– 2.1 mm
O	178	– 2.5 mm
N	172	– 3.0 mm
M	161	– 3.7 mm
L	152	– 4.3 mm
K	143	– 4.8 mm
J	135	– 5.3 mm
I	127	– 5.7 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DSC11 03 06	PE 6 P 120 A 720 RS 7015	RQV 200–1000 PA 768
Assy. No. 0 402 646 828		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	213	– 0.3 mm
X	204	– 0.6 mm
Q	199	– 0.9 mm
Z	190	– 1.2 mm
O	184	– 1.5 mm
N	175	– 1.8 mm
M	159	– 2.5 mm
L	148	– 3.0 mm
K	138	– 3.5 mm
J	129	– 4.0 mm
I	121	– 4.4 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 01 06	PE 8 P 110 A 920/4 LS 3020	RQV 250–1000 PA 306/2 R
Assy. No. 0 401 848 717		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 1000	Control–rod–travel change on full–load adjustment
X	154	– 0.5 mm
Z	145	– 1.1 mm
M	127	– 2.1 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS 14 06, 07 DS 14 06 Crane	PE 8 P 120 A 920/4 LS 7002	RQV 250–1050 PA 547 RQV 200–1050 PA 547
Assy. No. 0 402 648 802		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control–rod–travel change on full–load adjustment
	700	
S	184	– 0.2 mm
X	176	– 0.6 mm
Q	170	– 0.8 mm
Z	164	– 1.1 mm
O	159	– 1.3 mm
N	153	– 1.6 mm
M	145	– 2.1 mm
L	137	– 2.6 mm
K	131	– 3.0 mm
J	122	– 3.5 mm
I	114	– 4.0 mm

The test specifications apply for calibration oil ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 06, 07 DS 14 06 Crane	PE 8 P 120 A 920/4 LS 7002	RQV 275–1000 PA 547–3
Assy. No. 0 402 648 810		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	184	– 0.2 mm
X	176	– 0.6 mm
Q	170	– 0.8 mm
Z	164	– 1.1 mm
O	159	– 1.3 mm
N	153	– 1.6 mm
M	145	– 2.1 mm
L	137	– 2.6 mm
K	131	– 3.0 mm
J	122	– 3.5 mm
I	114	– 4.0 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 06, 07 DS 14 06 Crane	PE 8 P 120 A 920/4 LS 7002	RQV 250–1000 PA 547 RQV 200–1000 PA 547
Assy. No. 0 402 648 810		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	184	– 0.2 mm
X	176	– 0.6 mm
Q	170	– 0.8 mm
Z	164	– 1.1 mm
O	159	– 1.3 mm
N	153	– 1.6 mm
M	145	– 2.1 mm
L	137	– 2.6 mm
K	131	– 3.0 mm
J	122	– 3.5 mm
I	114	– 4.0 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 42 Case	PE 8 P 120 A 920/4 LS 7002-1	RSV 350-1050 P1/504
Assy. No. 0 402 648 810		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1	Control-rod-travel change on full-load adjustment
	700	
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DSC 14 01	PE 8 P 120 A 920/4 LS	RQV 200–950 PA 547–1
DSC 14 01 Crane	7008	RQV 275–900 PA 547–4
DSC 14 02	..7008 X	RQV 200–950 PA 547–1
DSC 14 01	..7108	RQV 200–950 PA 736

Assy. No. 0 402 648 807, ..811, ..813, ..815

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	192	– 0.4 mm
X	184	– 1.1 mm
Q	178	– 1.5 mm
Z	172	– 2.0 mm
O	168	– 2.3 mm
N	161	– 2.8 mm
M	155	– 3.4 mm
L	146	– 3.9 mm
K	139	– 4.3 mm
J	132	– 4.7 mm
I	126	– 4.9 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 40,42 DSI 14 40,42 Assy.No. 0 402 678 800	PE 8 P 120 A 920/4 LS 7002	RSV 350-1100 P 1/484

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1	Control-rod-travel change on full-load adjustment
	700	
U	229	+ 1.9 mm
R	224	+ 1.6 mm
W	218	+ 1.3 mm
V	210	+ 1.0 mm
Y	204	+ 0.7 mm
T	195	+ 0.4 mm
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm
O	159	- 1.3 mm
N	153	- 1.6 mm
M	145	- 2.1 mm
L	137	- 2.6 mm
K	131	- 3.0 mm
J	122	- 3.5 mm
I	114	- 4.0 mm

The test specifications apply for calibration oil to ISO-4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 41 DSI 14 42, 43 Assy. No. 0 402 648 803, ..804, ..805	PE 8 P 120 A 920/4 LS 7003	RQV 750 PA 528 RQV 900 PA 528 RQV 1050 PA 528

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1			Control-rod-travel change on full-load adjustment
	700	850	1000	
U	246	241	243	+ 2.1 mm
R	238	235	237	+ 1.8 mm
W	231	227	231	+ 1.5 mm
V	223	219	224	+ 1.2 mm
Y	214	210	216	+ 0.8 mm
T	205	204	210	+ 0.4 mm
S	183	183	194	- 0.2 mm
X	179	180	190	- 0.4 mm
Q	173	177	187	- 0.6 mm
Z	165	171	180	- 0.9 mm
O	160	166	175	- 1.1 mm
N	154	161	170	- 1.4 mm
M	147	154	162	- 1.8 mm
L	140	147	154	- 2.2 mm
K	134	139	145	- 2.6 mm
J	126	132	137	- 3.0 mm
I	121	125	128	- 3.5 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

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RSV..MW.. GOVERNOR

Workshop: EP
12. 1987

Assembly specifications for solenoid of unlocking device for starting.

The assembly specifications apply to the MW pump assemblies with the assembly numbers:

0 403 476 028 and
0 403 476 036

When assembling the electromagnets of the unlocking device for starting, it is possible that the bell crank will lock the control rod which is positioned in the start position.

To prevent this from happening, the control rod must be positioned to the STOP position before the pushing electromagnet is inserted. It must then be possible to assemble the electromagnet without any resistance.

When assembly is complete, check the control rod for freedom of movement.

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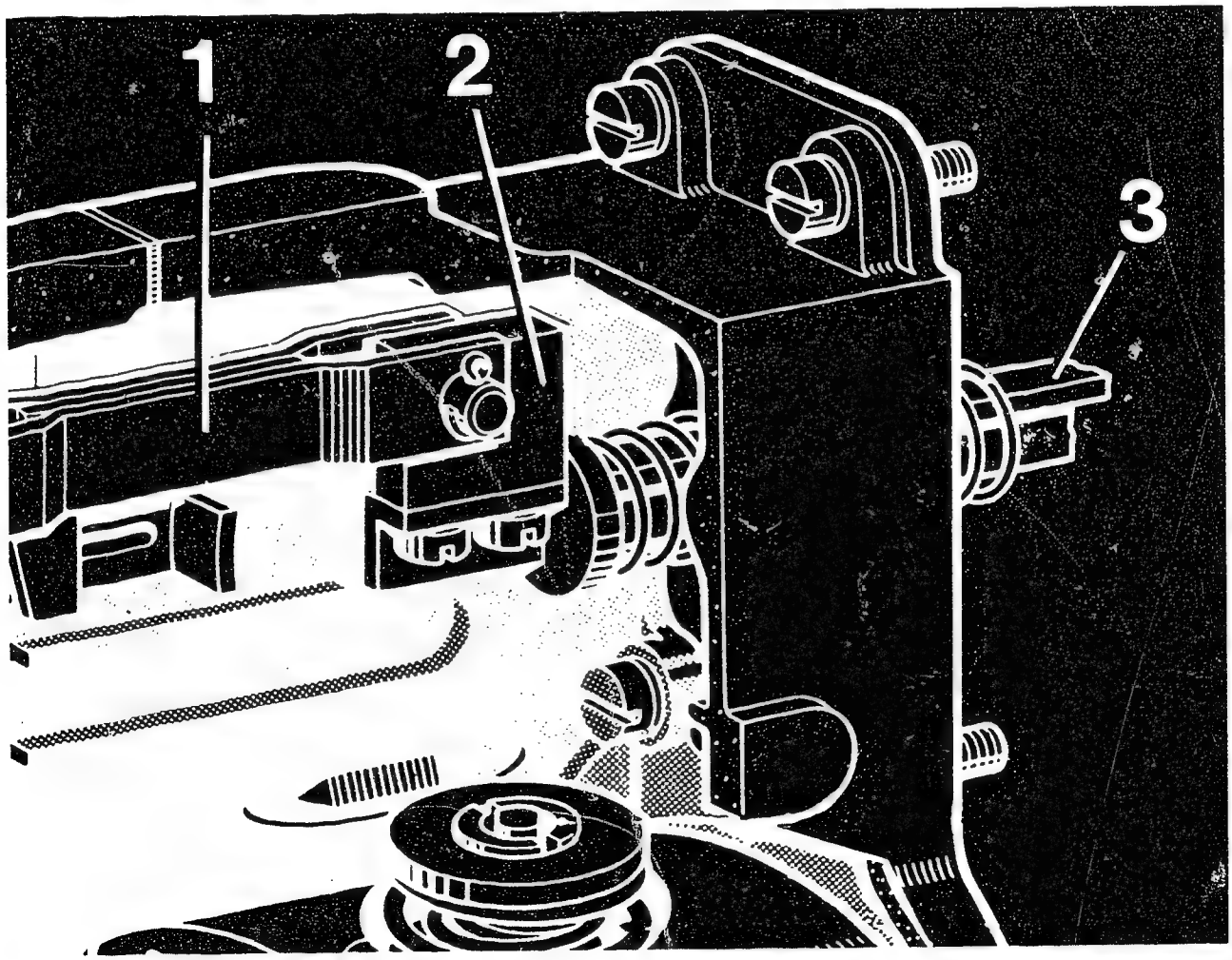
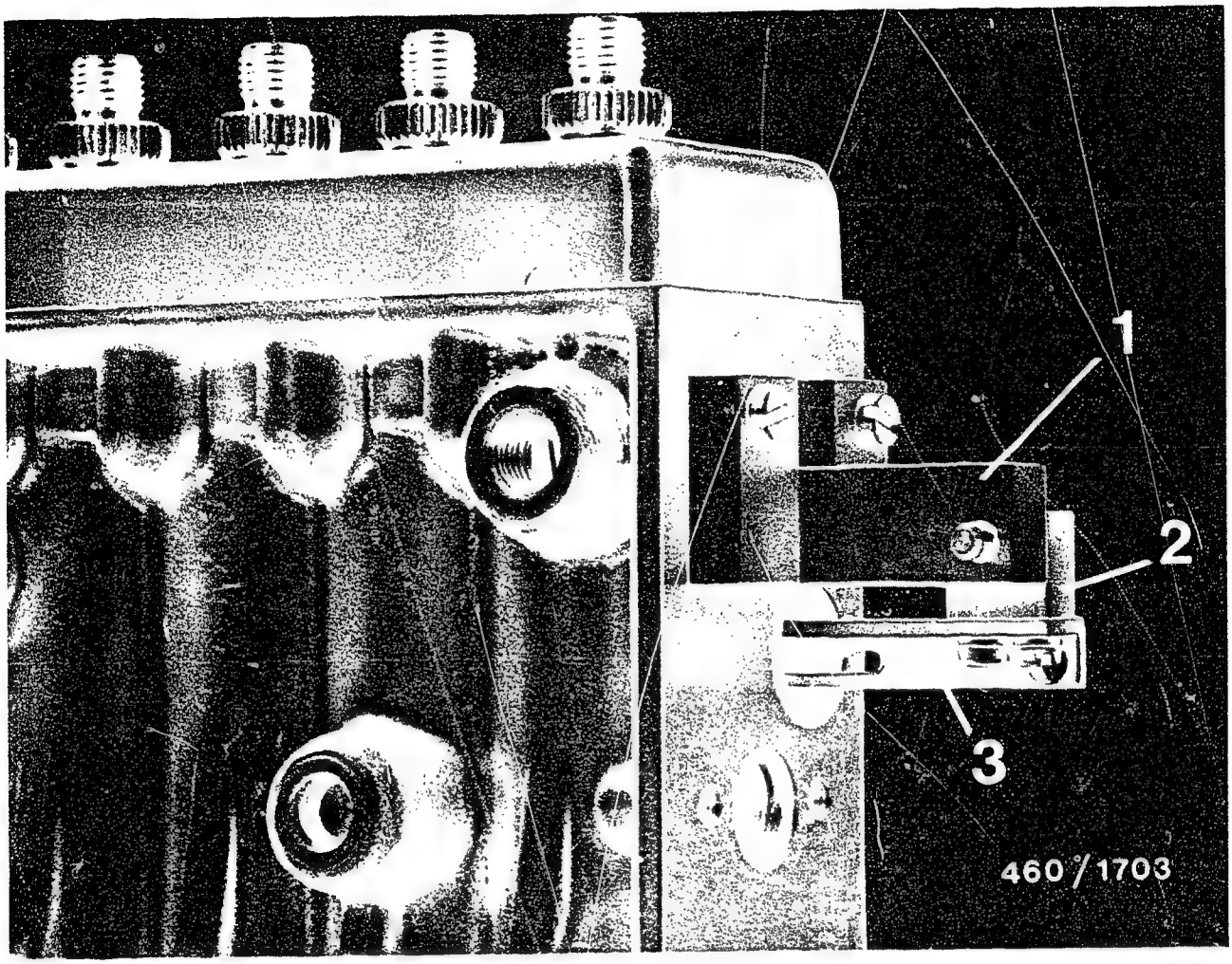
Assembly specification for intermediate piece on control rod

In order to prevent the movement of the control rod from becoming stiff, the intermediate piece (see illustration) must be assembled parallel to the direction of movement of the control rod.

1 = Link fork 2 = Intermediate piece 3 = Control rod





1 = KDEP 1617
2 = Intermediate piece
3 = Control rod

The intermediate piece is mounted on the control rod with the aid of the after-sales service tool KDEP 1617 (see illustration).

When using this tool, make sure that the plane surface of the pump end face is free of gasket remnants and residues before positioning the tool on this surface. This is necessary in order to ensure that the tool is properly seated.

Once the tool has been located with two screws and the pin of the intermediate piece has been inserted into the bore of the tool, the two fastening screws are tightened (illustration, arrows).

The fastening screws must be secured by spring lock washers (use new spring lock washers).

Tightening torque: 3.5...5.5 Nm

Remove the screws from KDEP 1617 and remove the tool.

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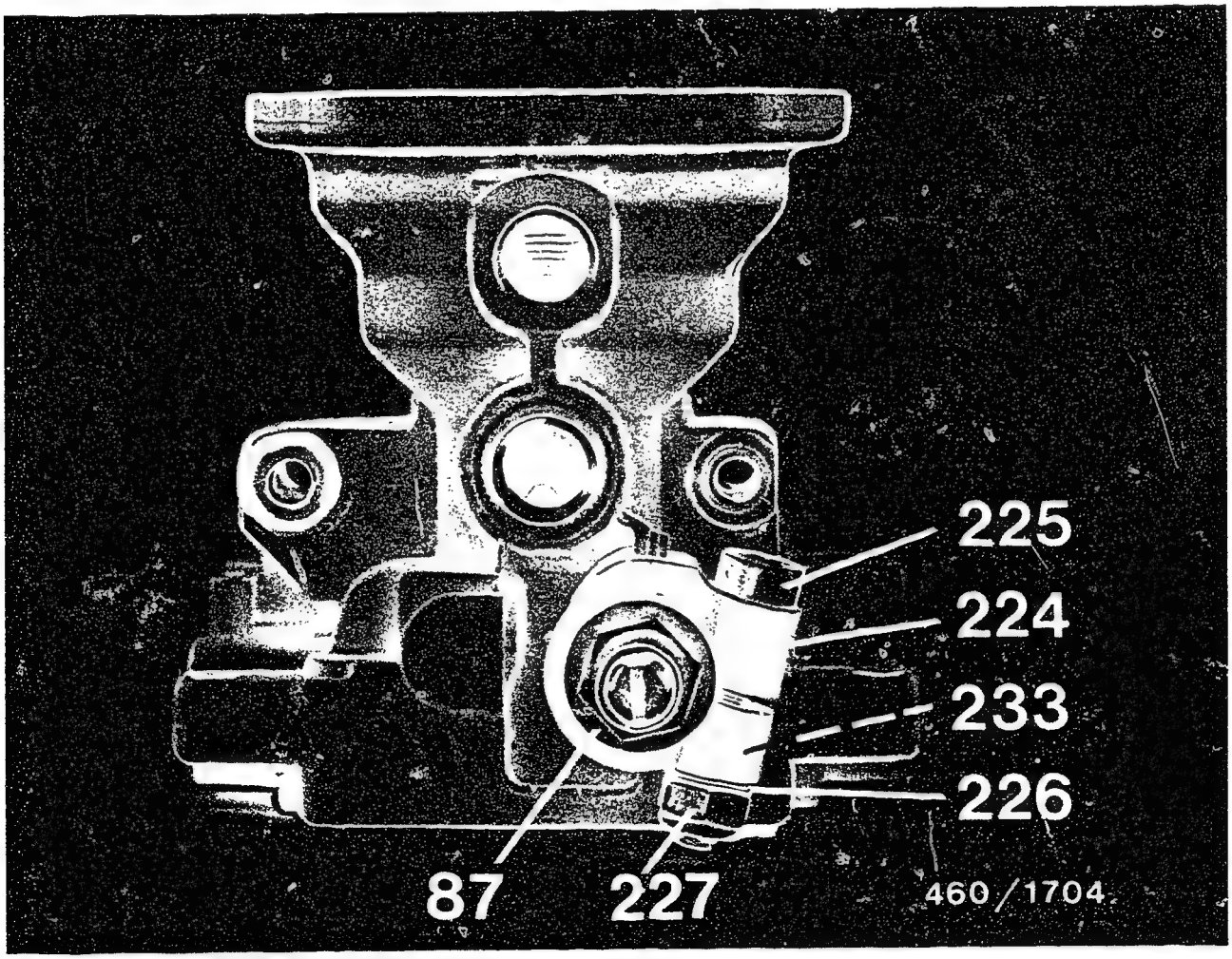
VE 6/10F 2300 R206 – 0 460 406 047 (BMW 324 d)

Workshop: EP
02.1988

Technical modification while retaining the
Part Number

0052 En

As of FD 742 (2.87), the above-mentioned VE-EP has been modified while retaining the part number 0 460 406 047.
The VE-EPs up to FD 741 (1.87) and as of FD 742 (2.87) are not interchangeable.
In addition to the FD, the external distinguishing feature of the new VE-EP is the lack of full-load-adjustment device (see illustration).



The service parts and test specifications of the VE-EP up to FD 741 can no longer be documented on the microcards EP.. and WP... Listed below according to FD are the differing service parts which must be used.

0 460 404 040 up to FD 741

Item	Part Number	Description
29	1 466 111 385	Cam plate
50	1 468 336 391	Hydraulic head
58	1 463 370 367	Fitting
87	1 466 300 303	Worm wheel
88	1 463 402 334	Adjusting screw
93	1 460 410 306	Spacer sleeve
224	1 465 132 495	Adjustment housing
225	1 463 414 318	Adjusting screw
226	2 916 069 083	Spring washer
227	2 915 062 004	Hexagon nut
233	1 460 422 358	Guide sleeve

0 460 404 040 as of FD 742

Item	Part Number	Description
29	1 466 111 341	Cam plate
50	1 468 336 409	Hydraulic head
58	1 463 370 377	Fitting
87	2 916 012 015	Plain washer
88	1 463 402 330	Adjusting screw
93	1 460 410 302	Spacer sleeve
224	—	not applicable
225	—	not appllicable
226	—	not applicable
227	—	not applicable
228	—	not applicable

All other service parts are identical and can be taken from the valid service-parts microcard EP.. in each case.

The test specifications for VE-EPs up to FD 741 are on the following pages of this Service Information.

The test specifications for VE-EPs as of FD 742 are published in the test-specifications microcards WP.. .

For exchange purposes (Index 090), only the latest version of VE-EP (as of FD 742) are supplied.

When replacing a VE-EP with FD up to 741, it is necessary to install flat-type pintle nozzles 0 430 250 148 (DN 0 SD 286) p ö = 130 bar, since there may otherwise be a complaint due to constant bucking when driving.

BOSCH EP TEST SPECIFICATIONS

Pay attention to information in the Remarks column

Test-specification sheet	: BMW 2.4 E
Edition	: 19.12.86
Supercedes	: 10.85
Calibrating oil	: ISO 4113
Injection pump	: VE 6/10F2300 R206
Type number	: 0 460 406 047
Customer-specific details	
Customer	: BMW
Engine	: M21D24W

TEST-BENCH REQUIREMENTS

Calibrating-oil return temp.> °C	
with thermometer>	: 40...48
electronic>	: 42...50
Supply pressure bar	: 0.2
Calibrating nozzle-holder assembly>	: 1 688 901 022
Opening pressure> bar	: 130...133
Test fuel-injection tubing	: 1 680 750 073

Outer diameter		: 6
x Wall thickness>		: 2
x Length>	mm	: 450

Setting values of the injection pump
Check values in brackets

Timing-device travel:

Engine speed	1/min	: 1500
Charge-air pressure	hPa	: 500
Setting	mm	: 4.1...4.5
KSB sol.-op. valve>	Volt	: —

Supply-pump pressure

Engine speed	1/min	: 1500
Charge-air pressure	hPa	: 500
Setting	mm	: 5.9...6.5
KSB sol.-op. valve>	Volt	: —

Full-load delivery without charge-air pressure:

Engine speed	1/min	: 1250
Fuel delivery >	cm3/ 1000 strokes	: 27.5...28.5
KSB sol.-op.valve>	Volt	: —
Dispersion >	cm3/ 1000 strokes	: 3.5 : —

Low-idle speed regulation:

Engine speed	1/min	: 400
Charge-air pressure	hPa	: 500
Fuel delivery >	cm3/ 1000 strokes	: 6.0...10.0
KSB sol.-op. valve>	Volt	: —
Dispersion >	cm3/ 1000 strokes	: 3.5 : —

Full-load speed regulation:

Engine speed	1/min	: 2500
Charge-air pressure	hPa	: 500

Fuel delivery	cm3/	
>	1000 strokes	: 11.5...17.5
KSB sol.-op. valve>	Volt	: —
Dispersion	cm3/	: 5.0
>	1000 strokes	: —

Starting:

Engine speed	1/min	: 100
Charge-air pressure	hPa	: —
Fuel delivery	min.	
>	cm3/1000 strokes	: 45.0
KSB sol.-op. valve>	Volt	: —
Dispersion	cm3/	: —
>	1000 strokes	: 12.0

Test specifications of the injection pump
Check values in brackets

Timing-device characteristic:

1. Engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 3.0...4.0
>	mm	: (2.8...4.2)
KSB sol.-op. valve>	Volt	: 12.0
2. Engine speed	1/min	: 1000
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 4.5...5.5
>	mm	: (4.3...5.7)
KSB sol.-op. valve>	Volt	: 12.0
3. Engine speed	1/min	: 750
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 0.8...1.6
>	mm	: (0.5...1.9)
KSB sol.-op. valve>	Volt	: —
4. Engine speed	1/min	: 1500
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: —
>	mm	: (3.6...5.0)
KSB sol.-op. valve>	Volt	: —
5. Engine speed	1/min	: 2000
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 6.1...6.9
>	mm	: (5.8...7.2)

Supply-pump-pressure characteristic:

1. Engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
Supply-pump pressure>	bar	: 3.1...3.7
KSB sol.-op. valve>	Volt	: —
2. Engine speed	1/min	: 2000
Charge-air pressure	hPa	: 500
Supply-pump pressure>	bar	: 7.2...7.8
KSB sol.-op. valve>	Volt	: —

Overflow quantity at overflow valve:

1. Engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
KSB sol.-op. valve>	Volt	: —
Overflow quantity>	cm3/10	: (26...98)
2. Engine speed	1/min	: 2300
Charge-air pressure	hPa	: 500
KSB sol.-op. valve>	Volt	: —
Overflow		: 55...138
quantity>	cm3/10	: (40...153)

Fuel-delivery and breakaway characteristic:

1. Engine speed	1/min	: 1250
Charge-air-press. setting point>	hPa	: 120
LDA stroke	mm	: 5.0
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 23.2...26.7
	1000 strokes	:(22.7...27.3)
2. Engine speed	1/min	: 2650
Charge-air pressure	hPa	: 500
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: 0 ...6.0
3. Engine speed	1/min	: 2500
Charge-air pressure	hPa	: 500
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: (10.5...18.5)
4. Engine speed	1/min	: 2300
Charge-air pressure	hPa	: 500
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 26.2...29.2
>	1000 strokes	: (25.4...30.0)

5. Engine speed	1/min	: 1750
Charge-air pressure	hPa	: 500
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 28.8...32.2
>	1000 strokes	: (28.2...32.8)
6. Engine speed	1/min	: 1250
Charge-air pressure	hPa	: -100
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 22.0...24.0
>	1000 strokes	: (20.7...25.3)
7. Engine speed	1/min	: 1250
Charge-air pressure	hPa	: 120
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 23.3...26.7
>	1000 strokes	: (22.7...27.3)
8. Engine speed	1/min	: 1250
Charge-air pressure	hPa	: 500
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: (25.7...30.3)
9. Engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 27.5...30.5
>	1000 strokes	: (26.0...32.0)

Zero delivery (stop):

Mechanical shutoff:

Engine speed	1/min	: —
Fuel delivery	cm3/	: —
>	1000 strokes	

Electr. shutoff:

Engine speed	1/min	: 400
ELAB	Volt	: —
Fuel delivery	cm3/	: —
>	1000 strokes	

Idle delivery:

1. Engine speed	1/min	: 400
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: (4.0...12.0)
2. Engine speed	1/min	: 450
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: 0...6.0

Automatic starting fuel delivery:

1. Engine speed	1/min	: 200
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 42.0...52.0
min. >	1000 strokes	: —
2. Engine speed	1/min	: 400
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 25.0...35.0
max. >	1000 strokes	: —
3. Engine speed	1/min	: 480
KSB sol.-op. valve>	Volt	: —
Fuel delivery	cm3/	: 21.7...26.3
>	1000 strokes	: —

Shutoff solenoid:

Cut-in voltage min.>	Volt	: 10.0
Nominal voltage	Volt	: 12.0

Dimensions for assembly and adjustment:

Designation		
K	mm	: 3.2...3.4
KF	mm	: 6.4...6.6
MS	mm	: 1.4...1.6
SVS max.	mm	: 3.9
XK	mm	: 17.0...19.0
XL	mm	: 9.6...13.0

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NOZZLE-AND-HOLDER ASSEMBLY 0 432 131 878

Workshop: EP
02.1988

SAAB-SCANIA ENGINES DS 9.01 and DSC 9.01

0056 En

Recently, there have been isolated cases of the needle valve of nozzle 0 433 171 084 (DLLA 142 P87) installed in the nozzle-and-holder assembly 0 432 131 878 breaking.

In order to avoid further failures, this nozzle has been modified. It now has the marking "87-" on its shaft.

The associated nozzle-holder assembly 0 430 133 997 (KDEL 97 P3) has been modified in the following way.

- Spacer 2 430 136 121 with identification groove at its circumference (see illustration a).

- Pressure spring 2 434 614 027 with varying coil spacing = progressive spring (see illustration b).

Marking of the nozzles started with the date of manufacture 552. Nozzles and nozzle-holder assemblies manufactured as of the date of manufacture 641 do not have this special identification mark, however, they still correspond to the new version.

Nozzles and nozzle-and-holder assemblies which correspond to the modified version must be exchanged only as a set on any one individual engine. The nozzles and assemblies must not be mixed; i.e., when there is a complaint concerning a nozzle-and-holder assembly, all of the nozzle-and-holder assemblies must be converted to the latest state of the art.
Outside the warranty period, conversion is not free of charge.

Items in stock which do not correspond to the modifications described in this Service Information may be sent to K5/QSG with KH/VKD delivery note and warranty report for crediting. In order to garantee rapid service, we recommend that you stock up with the appropriate modification parts.

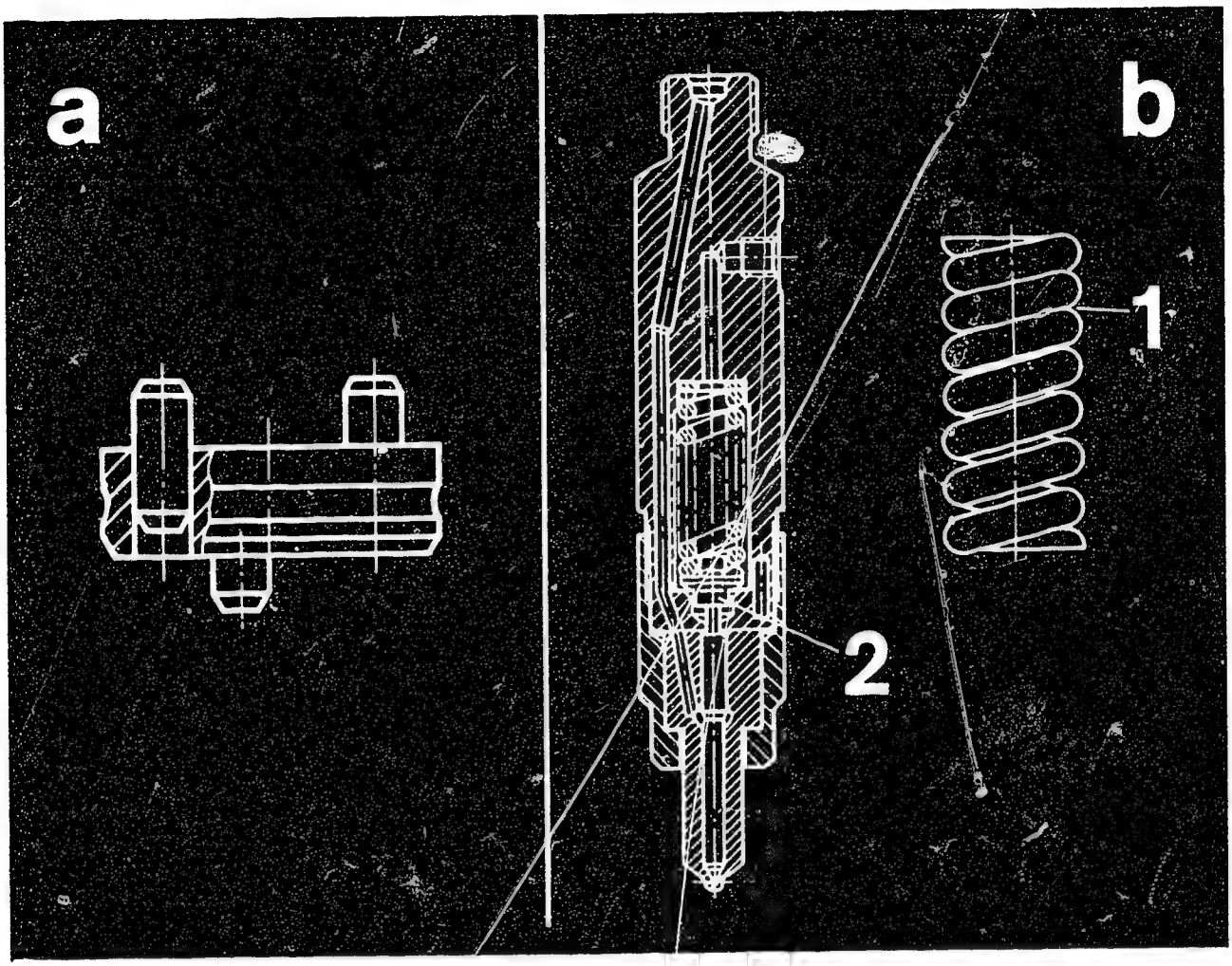

Illustration a = Spacer with identification groove
Illustration b: 1 = Pressure spring (progressive)
2 = Spacer

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LOOSE BEARING END PLATE AND BEARING DAMAGE IN INJECTION PUMPS PE..P..S (SERIES 3000) in Mercedes-Benz commercial vehicles with engine OM 421, A, OM 422, A, LA, OM 423, A, LA

Workshop: EP
03.1988

0057 En

In the case of the above-mentioned injection pumps (up to FD 343), isolated cases of loose bearing-end-plate fastening screws and bearing damage are being reported.

If injection pumps with these faults come to light, proceed in the following manner:

* Visual examination looking for wear of the bearing-end-plate seat in the housing.
  Replace pump housing with worn seat. When doing this, always convert to the appropriate "-10 version" (for this, see microcard W-400/006 E12).

If the pump housing is not damaged, then proceed in the following manner:

* Using a screw cap (tap drill), remove any remnants of adhesive from the thread of the fastening screws in the pump housing.
  Repair damaged thread using a screw-thread insert.
* Replace the bearing end plate, start-of-delivery pointer, fastening screws, and plain washers by the following new parts:

Quantity	Description	Part No.
1	Bearing end plate	2 415 551 072
4	Hexagon-socket-head cap screw M 6 x 30	2 914 559 101
4	Seal ring	2 410 113 006
1	Pointer	2 411 331 038
2	Spring lock washer	2 916 693 005
2	Hexagon bolt M 6 x 10	2 911 062 191

* The tightening torque for the hexagon-socket-head cap screws is 10...12 Nm.

* When repairing injection pumps with bearing damage at the governor or drive end, the new parts listed must likewise be used (for bearings, see service-parts micro-card).

* When repair is complete, check the start-of-delivery marking and adjust if necessary.

In the case of injection-pump repairs which have been caused by a lack of oil, the customer must be informed that the lubricating oil supply of the ignition pump must be checked by a Mercedes-Benz dealership, if the closing sequence of the engine number is up to and including .. 096 161.

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INJECTION PUMPS (PE(S)..P..

Workshop: EP
03.1988

Modification of the threaded pin (Item 22)
on pump housings

0058 En

On all of the pump housings of the injection pumps PE(S)..P.. of the S 1, S 1000 and S 3000 series, the thread depth of the threaded pin (Item 22) is being modified from 14.2 mm to 19.2 mm.

This also changes the Part No. of the threaded pin (Item 22)

from	2 413 502 008
to	.. 012

The conventional threaded bolt .. 008 will continue to remain an exchangeable part. However, this pin must be used only in pump housings in which the thread depth has not been modified.

The threaded pin .. 012 must be used only in pump housings with modified thread depth.

Modification of the pump housing to the new thread depth began with FD 652 (12.86).

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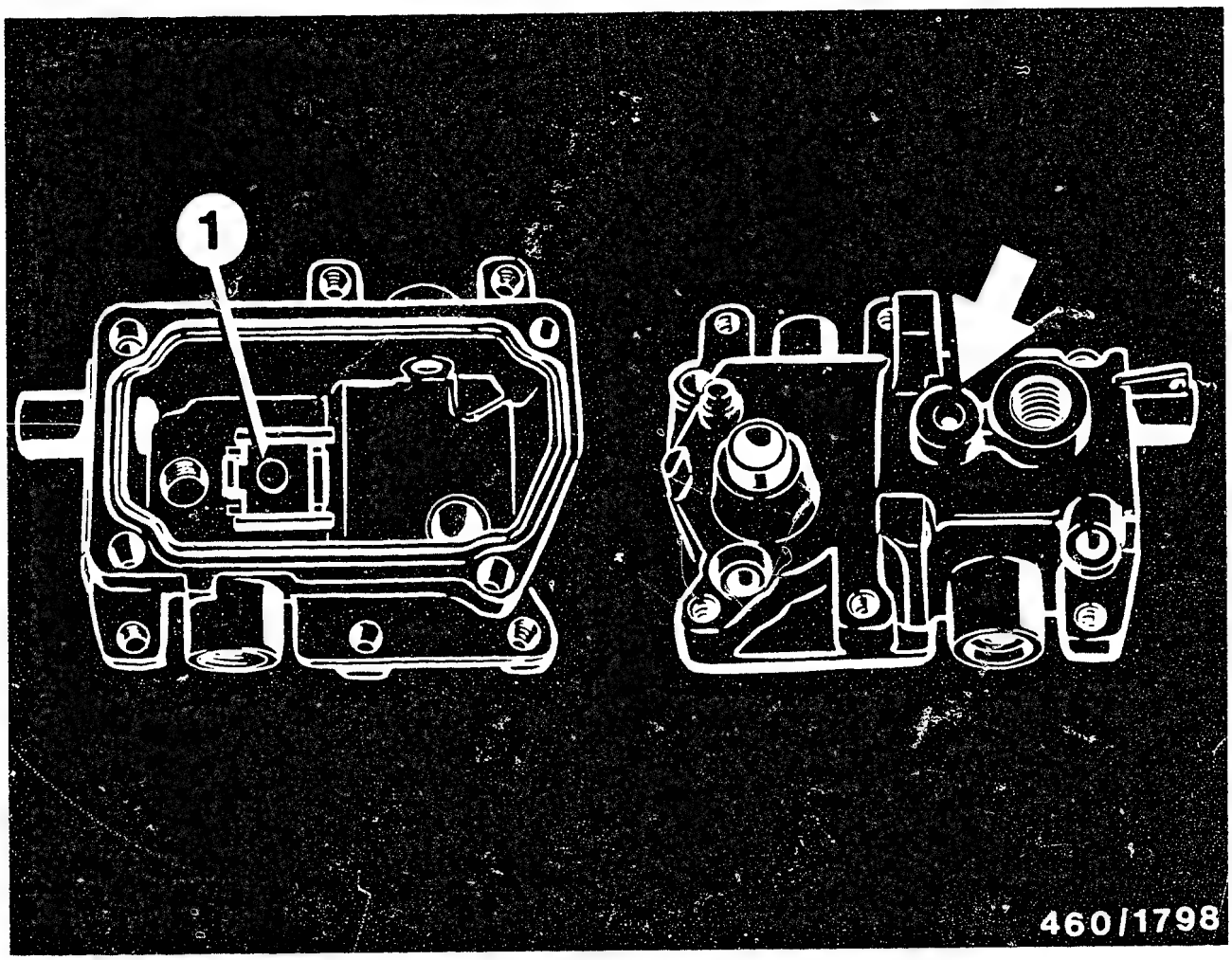
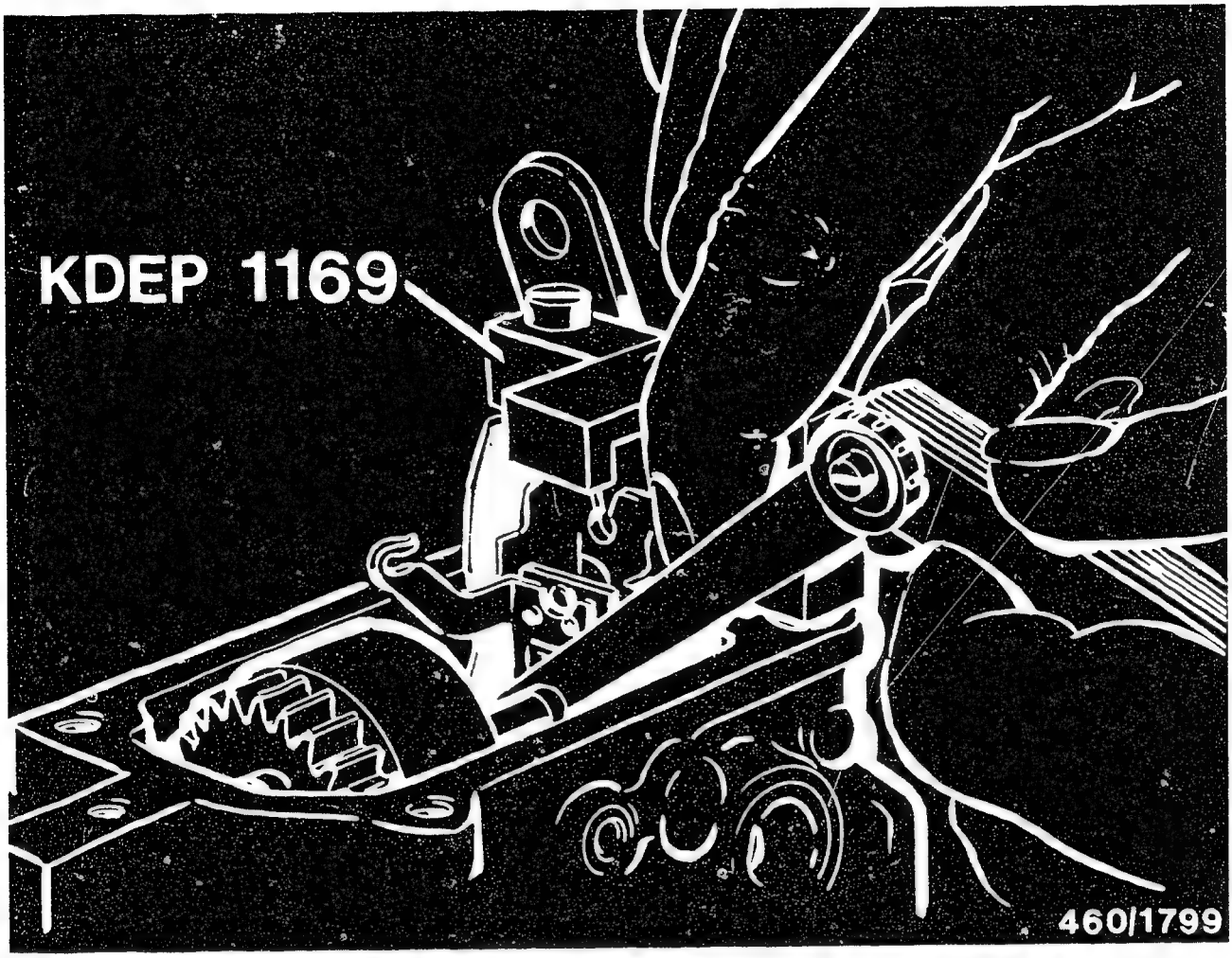
DISTRIBUTOR-TYPE FUEL-INJECTION PUMP VE..F..
R 162-2 AND R 162-4
0 460 4..
Modification of the housing cover

Workshop: EP
02.1988
0062 En

In the case of the above-mentioned injection pumps, the previous version with "fulcrum-lever stop in the distributor-type fuel-injection-pump housing" is being modified into a "fulcrum-lever stop in the housing cover" version. The version is characterized externally by a depression in the housing cover (arrow).

1 = Fulcrum-lever stop in the housing cover





This further design development means that a new after-sales-service tool is required for adjusting the sleeve starting travel (illustration). Part designation of the tool: KDEP 1169.

The procedure for adjustment (sleeve-start dimension) as described in VDT-W-460/100 is not changed by the use of this new tool.

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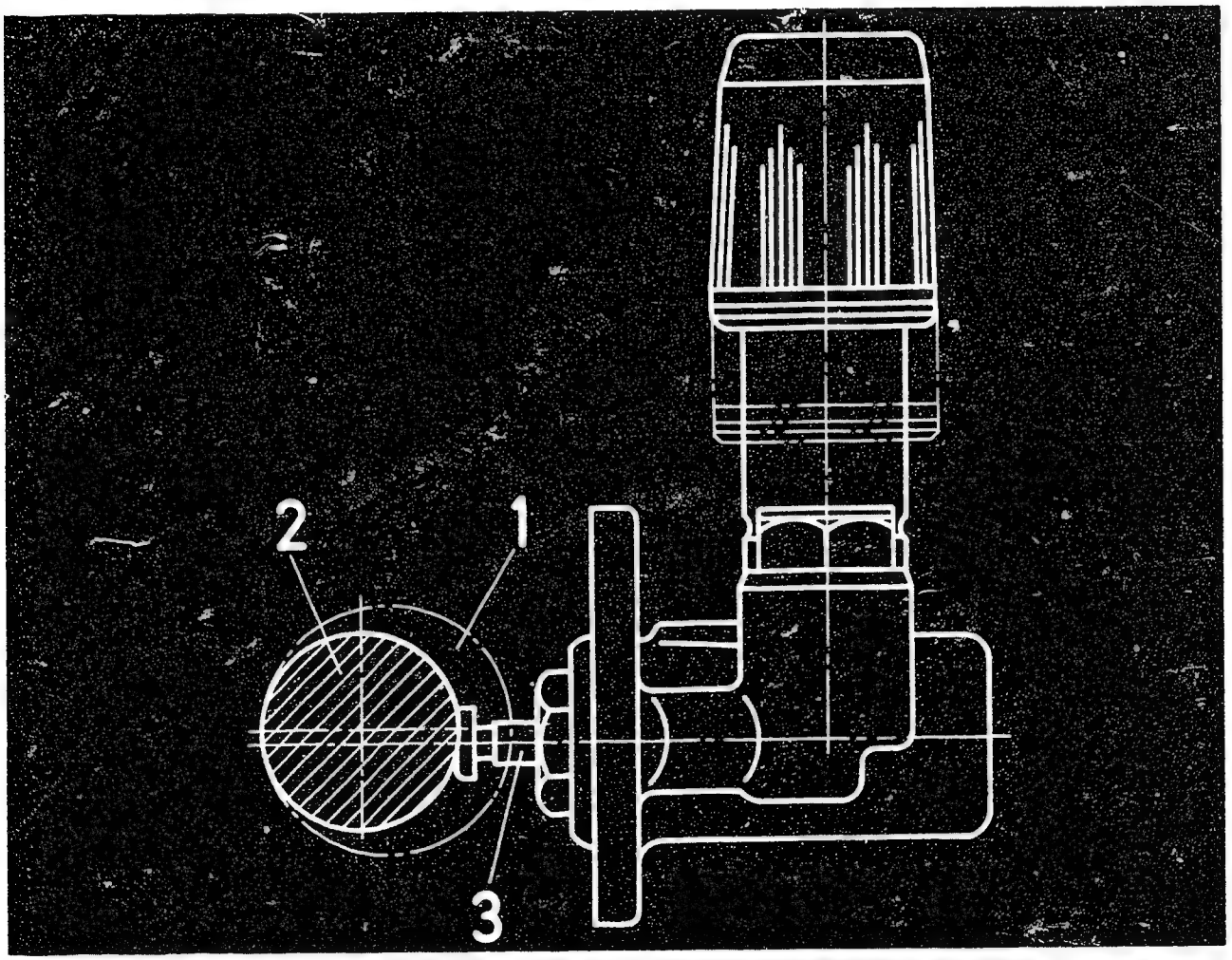
Flange fractures

1 = Supply-pump cam
2 = Camshaft
3 = Sliding tappet



A number of isolated cases of fractures of the flange of sliding-tappet supply pumps mounted on P and MW in-line fuel-injection pumps have come to light.

The cause of these fractures is deformation due to improper securing of the supply pump when mounting on the pump assemblies.

Note on assembly:

* Turn the supply-pump cam of the injection-pump camshaft to BDC position.

* Press the supply pumps flat and centrally until they make contact with the sealing surface of the flange and tighten to 7...9 Nm.

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ELECTRONIC DIESEL CONTROL
WITH DISTRIBUTOR-TYPE FUEL-INJECTION PUMP VE..E..

Workshop: EP
02.1988

Procedures for after-sales service

0068 En

System information

As opposed to conventional diesel fuel-injection systems with a mechanically controlled distributor-type fuel-injection pump (VE...F...), electronic diesel control (EDC) features a distributor-type fuel-injection pump with solenoid-operated control (VE...E...).

Externally, the distributor-type fuel-injection pump of the EDC system differs in that there is no control lever on the housing cover and that a wiring-harness plug is fitted in its place.

Further data is given in the System Information (please refer to SIS microcard mot. veh. ..., comm. veh./pass. car (engine) diesel fuel-injection pumps).

Users

The following manufacturers offer EDC for their vehicles:

Peugeot 505 td – since 01.87 in Austria and Switzerland

Citroen CX2500d – since 01.87 in Austria and Switzerland

BMW 524 td – since 03.87 in Austria (Austrian version)

BMW 324 td – since 09.87 in Europe

Test concept

After-sales service will be restricted in the initial phase to on-the-vehicle system testing. All EDC systems feature self-diagnosis.

On-the-vehicle trouble-shooting is effected in the simplest stage by triggering a self-diagnosis flashing code which after-sales-service specialists can use to determine the defective current path. In the second stage, after-sales-service specialists continue trouble-shooting in the defective current path with the aid of special test leads and a multimeter in order to precisely localize the fault.

In the event of a complaint which is not indicated by the self-diagnosis, trouble-shooting is carried out by way of special trouble-shooting instructions (see SIS microcard mot. veh. ...). The set values for system testing are always to be taken from the vehicle-specific SIS instructions in brief.

Testing the electronically controlled fuel-injection pump on a pump test bench is not initially envisaged. Distributor-type pumps found to be defective during the warranty period are to be sent in and replaced with exchange pumps (see warranty manual for address).

Repair

Repairs to electronically controlled distributor-type pumps are not initially envisaged.
The same applies to the nozzle-and-holder assembly with needle-motion sensor (NMS). Nozzle replacement on this holder with NMS is not permitted. All that can be done is to adjust the nozzle-opening pressure. Nozzle-and-holder assemblies without NMS are treated in the usual way.

As regards all other components, repair is neither economical nor in some cases possible (e.g. control units), with the result that such components must be replaced when spares are required.

Testers

Test adapter	KDEP 1165
Test leads	KDZS 0004 0005 KDUM 0007 0008
Multimeter	Commercially available e.g. F l u k e 75 Multimeter

Refer to SIS Microcard mot. veh... for further tools and testers.

Technical documentation

Equipment	Microcard AP...
List of spares (for nozzle-holder ass.)	Microcard EP...
Trouble-shooting on veh.	SIS Microcard mot. veh...
Test specifications	Contained in trouble-shooting instr.
Characteristic data	Microcards KP..., KE...
Exchange	Exchange list
Product/utilization	Microcard GD...

Warranty procedure

Components about which complaints are received are to be submitted during the warranty period together with warranty and goodwill claim and delivery note KH/VKD3 – 15333 for warranty assessment.

Bosch Service Stations in West Germany should take the shipment address from the warranty handbook.
In countries other than West Germany, components about which complaints are received should be sent to the Bosch representative in the country concerned together with a warranty and goodwill claim.

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DISTRIBUTOR-TYPE FUEL-INJECTION PUMP VE...F...

Workshop: EP
02.1988

VOLVO PENTA WITH ENGINES TAMD 31, TMD 31

0069 En

Changes to the timing device have been made on the pumps listed below, so as to improve the smoke and HC values when idling:

VE 4/11 F 1900 L 217	0 460 414 027
VE 4/11 F 1900 L 217-1	0 460 414 028
VE 4/11 F 1625 L 217-2	0 460 414 031
VE 4/11 F 1900 L 217-3	0 460 414 032
VE 4/11 F 1625 L 217-4	0 460 414 034
VE 4/10 F 1750 L 250	0 460 404 047

1. The above pumps are to be adjusted in accordance with the currently valid test-specification sheet.
   Part no. of timing-device piston: 1 463 104 393.

2. Pumps of the above-mentioned types which are marked with the additional letter "A" (e.g. VE 4/11 F 1900 L 217 A):
   Adjustment of these pumps is to be performed in accordance

   with the currently valid test-specification sheet (use test-specification sheet as outlined under 1). The cover of the timing device on the pressure side is to be replaced by a cover w i t h n o 2 mm washer.
   Following adjustment, the cover with 2 mm washer is to be fitted again.
   Part no. of timing-device piston: 1 463 104 393.

3. Pumps of the above-mentioned types with the additional letter "B" (e.g. VE 4/11 F 1900 L 217 B):
   The pumps are to be adjusted in accordance with the currently valid test-specification sheet..
   Part no. of timing-device piston: 1 463 104 468.

The information given under 3. applies if the timing-device piston 1 463 104 468 is fitted following repair work.

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NEW PRODUCT

Workshop: EP
02.1988

0070 En

START-OF-DELIVERY SENSOR SYSTEM (FBG)

For dynamic start-of-delivery testing
on in-line pumps

To date, the assignment of in-line pumps to the engine and the static start of delivery have been tested with the aid of the hydraulic overflow method employing pointer and mark.

In order to simplify this high-outlay service work, a measuring device has been developed for governors on in-line pumps which makes it possible to carry out the following adjustment and test procedures:

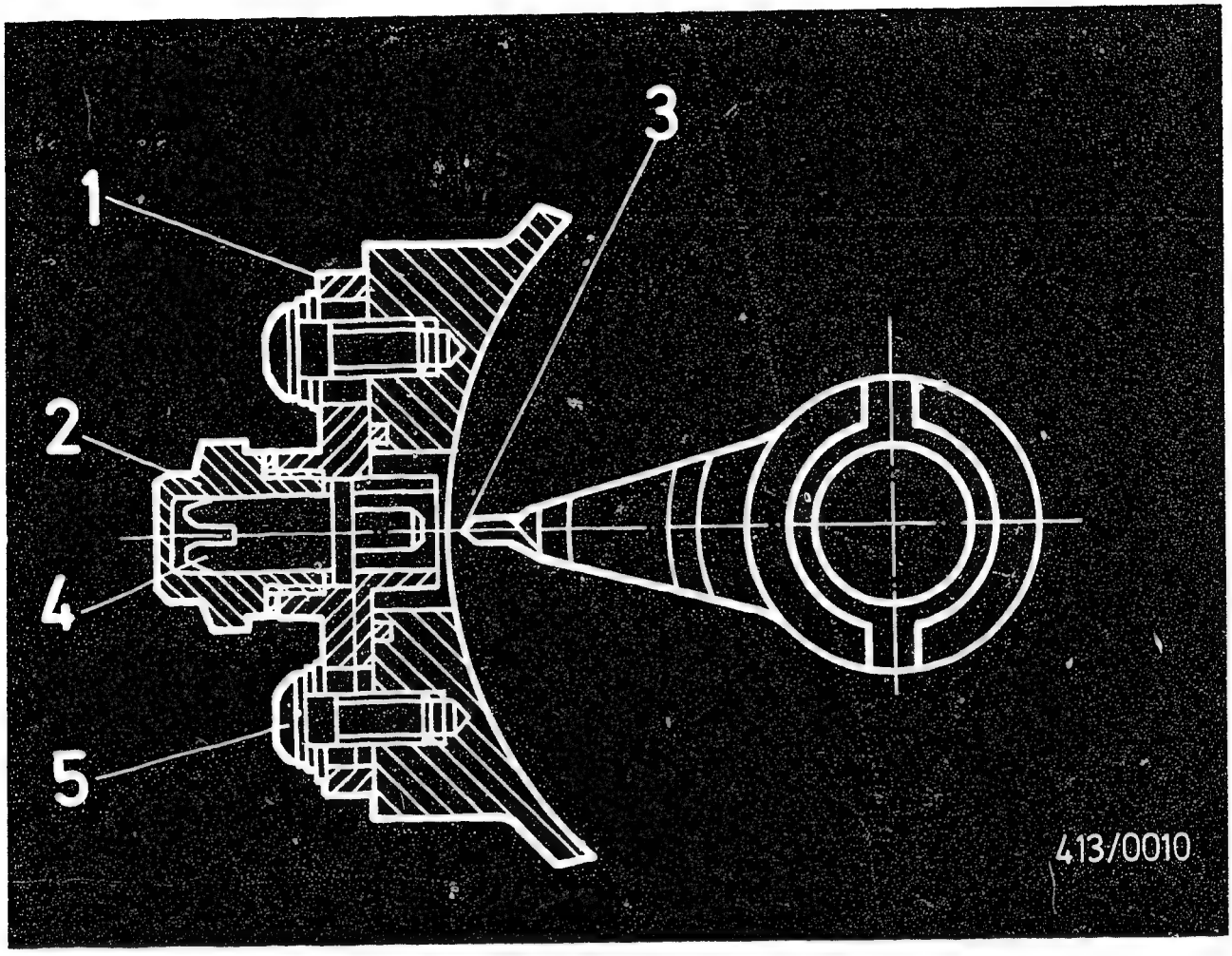
- Holding of injection-pump camshaft in start-of-delivery position of cylinder no. 1 for attachment to engine.
- Testing of start of delivery with engine running, so as to guarantee precise, optimum pump/engine assignment.
- Measurement of timing-device function in line with engine speed.

This new method has the following designation: Start-of-delivery sensor system (FBG).

Design and mode of operation

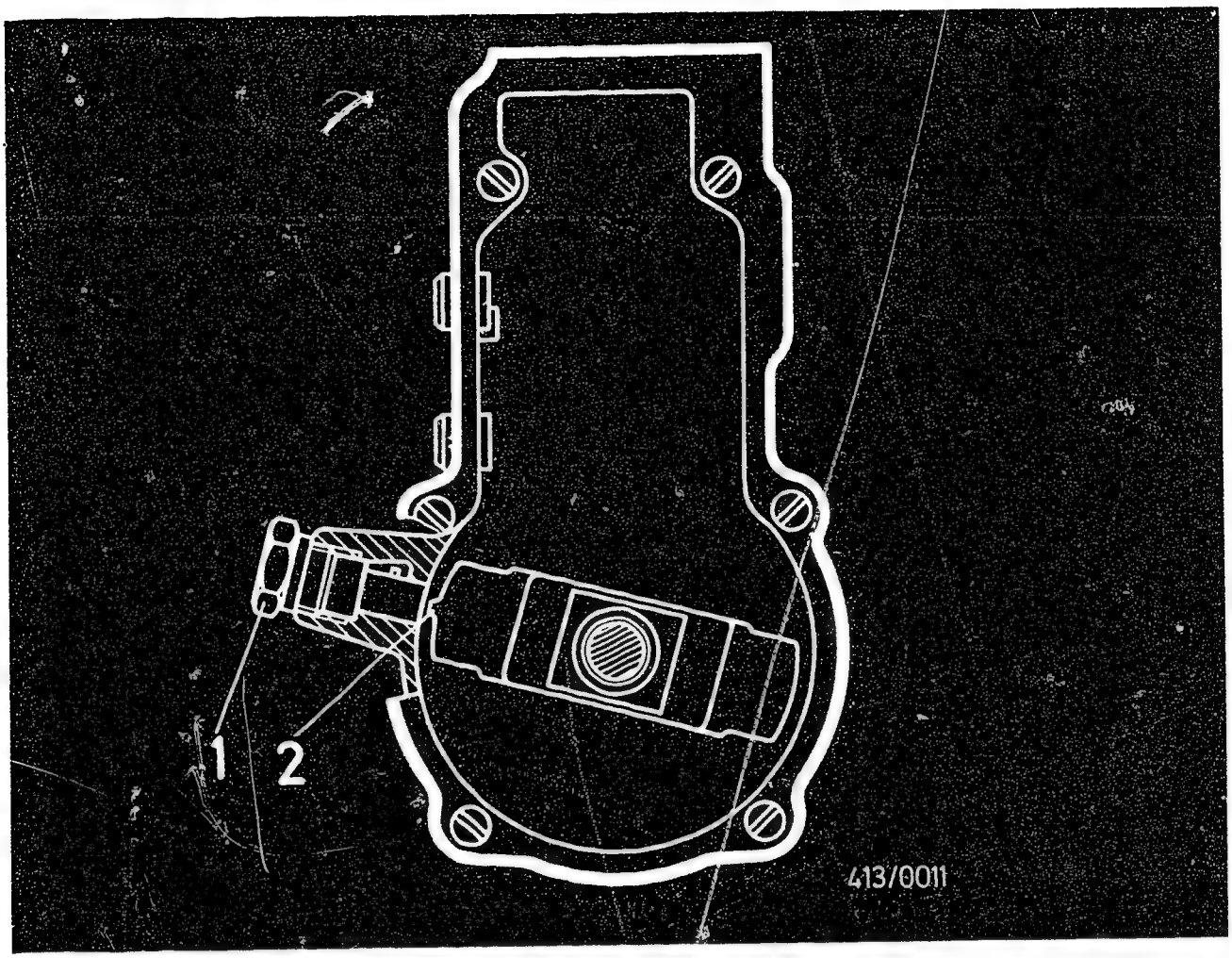
Two signals are needed for measuring injection pump/engine assignment:

- TDC pulse from engine crankshaft
- Governor pulse from fuel-injection pump (lug at flyweight or at pointer behind flyweights).



1 = Sliding flange
2 = Screw plug
3 = Lug (signal position) on pointer in RQ(V)..- and RSV governors
4 = Blocking pin
5 = Shear bolt M6

The governors have been provided on the outside of the governor housing with a sliding flange (1) with a hole for accommodating a holder or for an inductive pulse generator/ signal generator.
Furthermore, a pointer with lug (3) has been fitted behind the governor flyweights for signal triggering.
A blocking pin (4), which can be used to block the camshaft, is located in the screw plug (2).



1 = Screw plug
2 = Lug (signal position)

Exception:

The fuel-injection pump PES..M.. with RSF II governor has no sliding flange on the governor housing.

The hole for accommodating the pulse generator/holder was incorporated into the housing.

A lug (2) is provided directly at the flyweight for signal triggering.

The measurement signals are produced if the signal actuators (lug at flyweight section or pointer and TDC sensor pin at flywheel of crankshaft) are moved past the inductive sensors at a minimum speed (idle).

A measuring instrument measures the time interval between the two pulses and converts the result into an angle which is then indicated.

The diesel tester ETD 019.00 offered by IA 4 (part no. 0 684 101 900) can be used for this adjustment method.

Pump/engine assignment and dynamic start-of-delivery testing

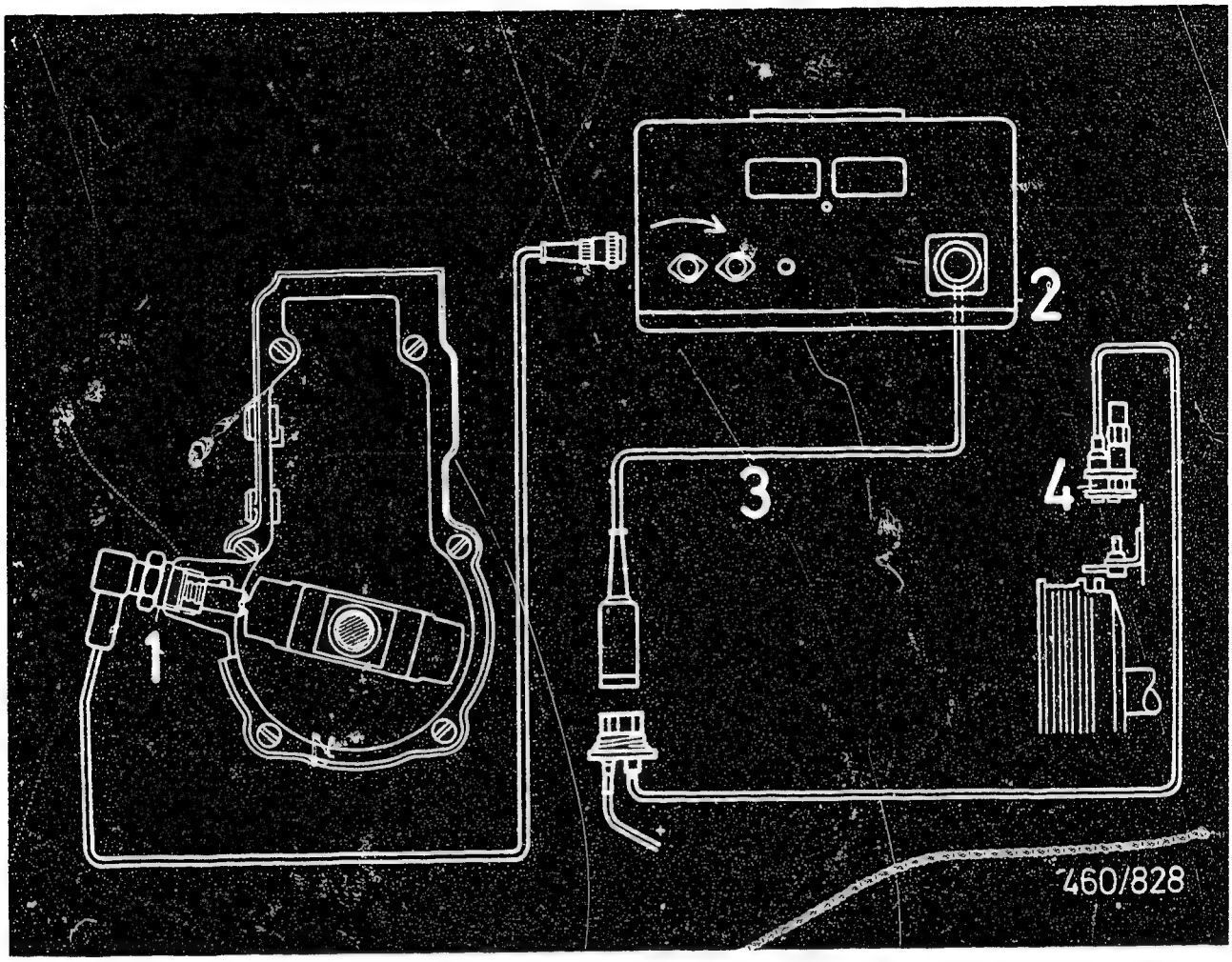
Turn engine crankshaft in accordance with adjustment specification to correct position.

Insert fuel-injection pump with holding device KDEP 1077 into engine flange.

I m p o r t a n t :

Danger of fuel-injection pump damage!
Remove holding device KDEP 1077 and replace it with screw plug immediately after installing fuel-injection pump (fastening screws tightened).

Connect diesel tester in accordance with connection diagram and perform dynamic testing.



1 = Governor pulse generator – part no. 1 687 224 667
2 = Diesel motortester ETD019.00 – part no. 0 684 101 900
3 = Adapter lead – part no. 1 684 463 147
4 = TDC sensor – part no. from original equipment manufacturer

Connection diagram for dynamic start-of-delivery testing with Diesel motortester ETD 019

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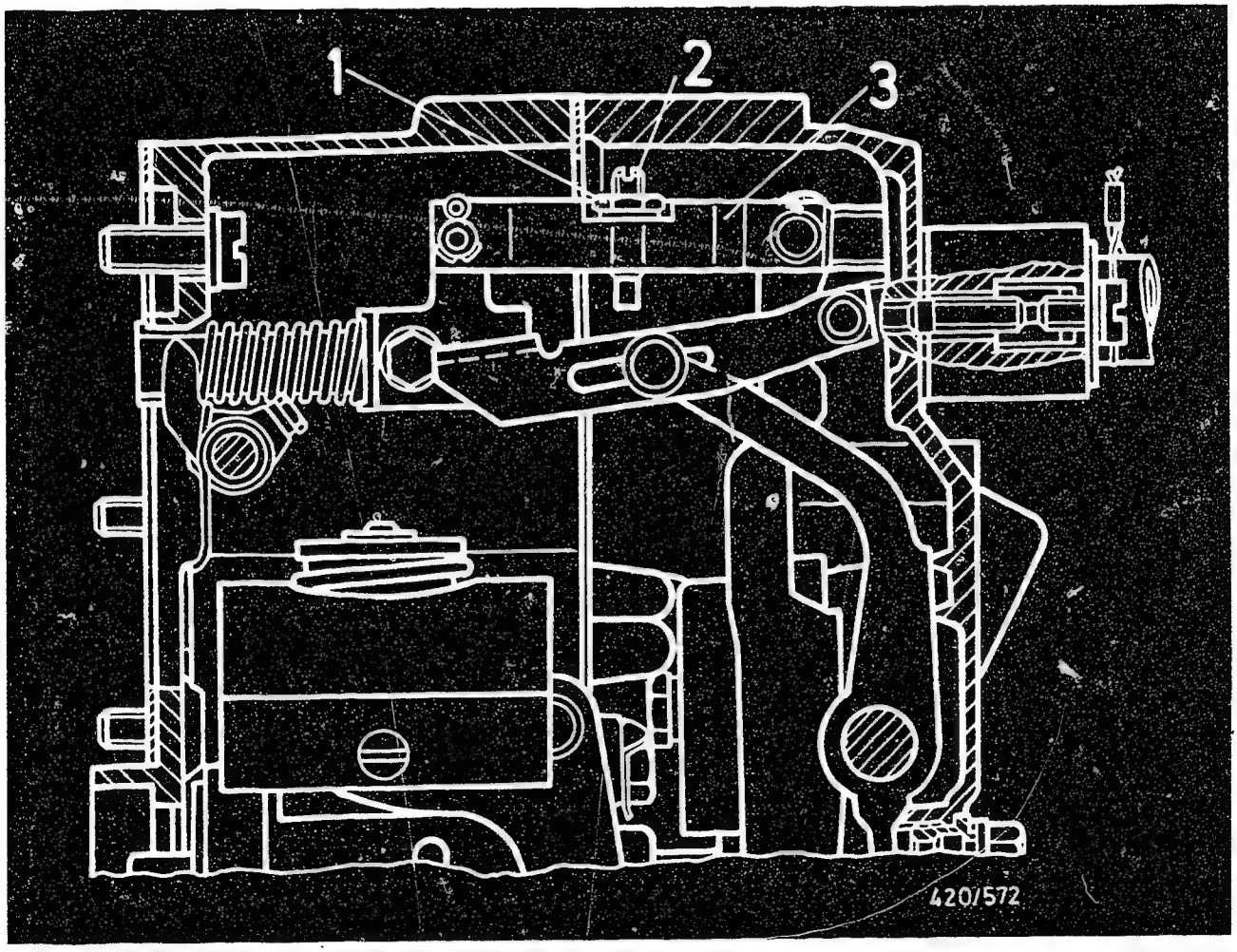
Adjustment of torque-control profile for injection-pump combinations

1 = Lock nut
2 = Locking screw
3 = Strap



When adjusting the following governors in the listed injection-pump combinations:

RQ 300/1300 AB 1204 R
in the injection-pump combinations 0 400 846 537
and 0 400 846 538

RQ 300/1300 AB 1205 R
in the injection-pump combination 0 400 846 539

the full-load stop of the control-rod stop is to be made inoperable for adjustment of the torque-control profile.

The following procedure is thus to be employed:

1. Loosen the lock nut (1). Unscrew locking screw (2) at strap (3) until full-load stop no longer has any effect.

2. Adjust/test torque-control profile in usual manner.

3. Screw locking screw (2) back in again and adjust full-load delivery.

4. Tighten lock nut (1).

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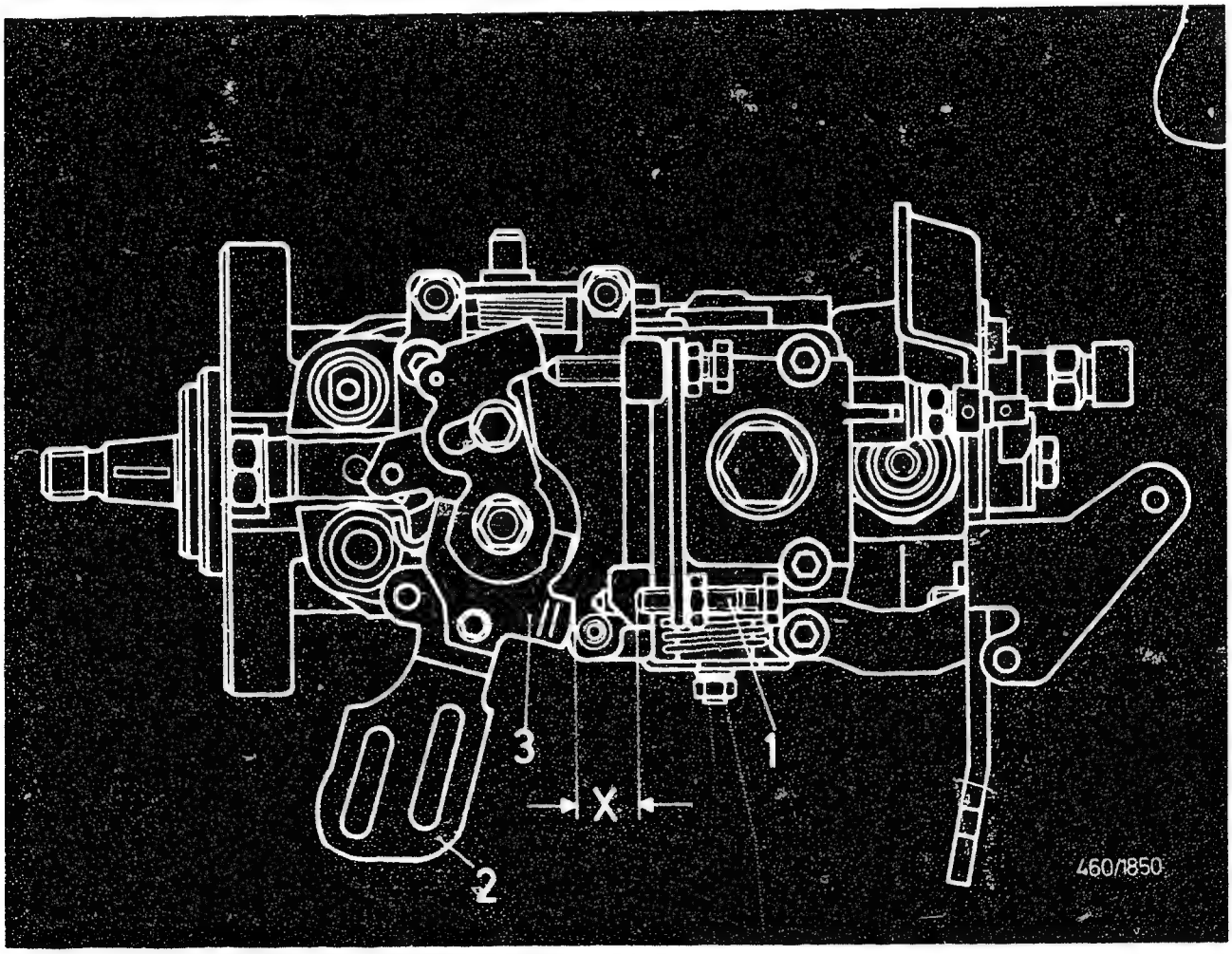
Testing and adjustment of EGR rate (EGR = Exhaust-gas recirculation)

1 = Adjusting screw (3rd stop)
2 = Control lever
3 = Driver



Testing and adjustment of the EGR rate is listed as an additional item (– assignment of driver at speed-control lever to linkage for exhaust-gas-recirculation valve (gauge) –) in the test-specification sheet and is performed on a pump test bench.

Procedure:

– Establish dimension "X" (Fig.) with the aid of a feeler gauge (0.1...2.0 mm, 0.1 mm increments; e.g. Hahn and Kolb, part no. 36 184) made up of various leaves
Position the gauge assembly at right angles to the adjusting screw (1); pull the driver (3) against the gauge assembly.

Measure rate. Adjust if necessary by turning adjusting screw (1).

The dimension "X" is given in the test-specification sheet under "remarks" (for adjustment of cut-in point (EGR valve), place spacer "X" mm in position at third stop).

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ADJUSTING DELIVERY OF FUEL-INJECTION-PUMP COMBINATIONS

Workshop: EP
02.1988

0 402 648 817 and
0 402 648 825 in Daimler-Benz engines OM 442

0074 En

1. Test specifications for fuel-injection-pump combinations:
The settings of the fuel-injection-pump combinations
PE 8 P 120 A 320 LS 7801 with RQ 300/1050 PA 762 – 0 402 648 817 and
PE 8 P 120 A 320 LS 7801 with RQV 300...1050 PA 797-1 – 0 402 648 825,
installed in engines of type OM 442A from Daimler-Benz,
were changed in the period between August 1986 and May
1987.

This modified setting was effected on all above-
mentioned fuel-injection-pump combinations installed
in engines from engine No. 003 812 to 013 027.
This was necessitated by the use of engine fuel-injection
tubing with a diameter of 1.8 mm instead of 2.0 mm.
When readjusting or checking such fuel-injection-pump
combinations, use is to be made of the following
setting-/check values:

Full-load delivery:

Engine speed (1/min)	Charge-air pressure (hPa)	Fuel delivery (cm3/1000 strokes)	Control-rod travel (mm)
600	650	203...205 (200...208)	14.1...14.3

Fuel-delivery characteristics:

Engine speed (1/min)	Charge-air pressure (hPa)	Fuel delivery (cm3/1000 strokes)	Control-rod travel (mm)
1050	1050	190...193 (187...196)	13.2...13.5
700	1050	215...219 (212...222)	14.6...14.9
850	1050	211...215 (208...218)	14.2...14.5
500	0	151...153 (147...156)	11.6...11.9

Check values are given in parentheses.

Settings for 2-stage manifold-pressure compensator at 600 1/min.

Pressure (hPa)	Control-rod travel (mm)
650	14.1...14.3
300	11.9...12.1
400	12.9...13.2
900	14.2...14.3

Prior to installing a fuel-injection-pump combination, which has been adjusted to the above-mentioned values, a check is to be made as to whether the engine is still fitted with fuel-injection tubing with an inside diameter of 1.8 mm.

Use is to be made of the test specifications on microcard WP.. for tubing with an inside diameter of 2.0 mm.

2. Nozzle-and-holder assembly

The opening pressure of the nozzle-and-holder assemblies for the above-mentioned engines is to be set to 200...208 bar

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Work units for add-on modules

The following WU for add-on modules shall apply provisionally until incorporation in the next edition of the DAT-BOSCH work units. They do not contain the necessary WU for the testing of pump and governor.

Add-on module VE..F..pump	Removal, disassembly, cleaning, repair, assembly, adjustment WU	Testing and adjustment in fitted condition WU
KSB (hydraulic)	4	11
LDA + KSB	16	10
LFG + KSB	6	7
LDA (ext. attachment)	12	12
TLA + KSB	7	—
HBA + KSB (adjustable)	13	
LFG (idle spring, fixed in housing)	6	5

FUEL-INJECTION-PUMP COMBINATIONS (IN-LINE PUMPS)

Add-on module	for pump	for governor	Removal, disassembly, cleaning, repair, assembly, adjustment WU	Testing and adjustment in fitted condition WU
LDA pump end	P	RQ, RQV	5	5
ADA	M	RSF	–	6
ALDA	MW	RW	4	8
ELR	M	RSF	4	3
FBG	M	RSF	4	3
LDA (2-stage)	P	RQ, RQV	6	9
LDA (horizontal)	A	RQV	5	4
LDA (horizontal)	MW	RQV	5	4
LDA (horizontal)	P	RQ	5	4
LDA (vertical)	A	RSV	4	5
LDA (vertical)	MW	RQV	5	3
LDA (vertical)	P	RSV	4	5
PLA	M	RSF		3
RWG	M	RSF	4	4

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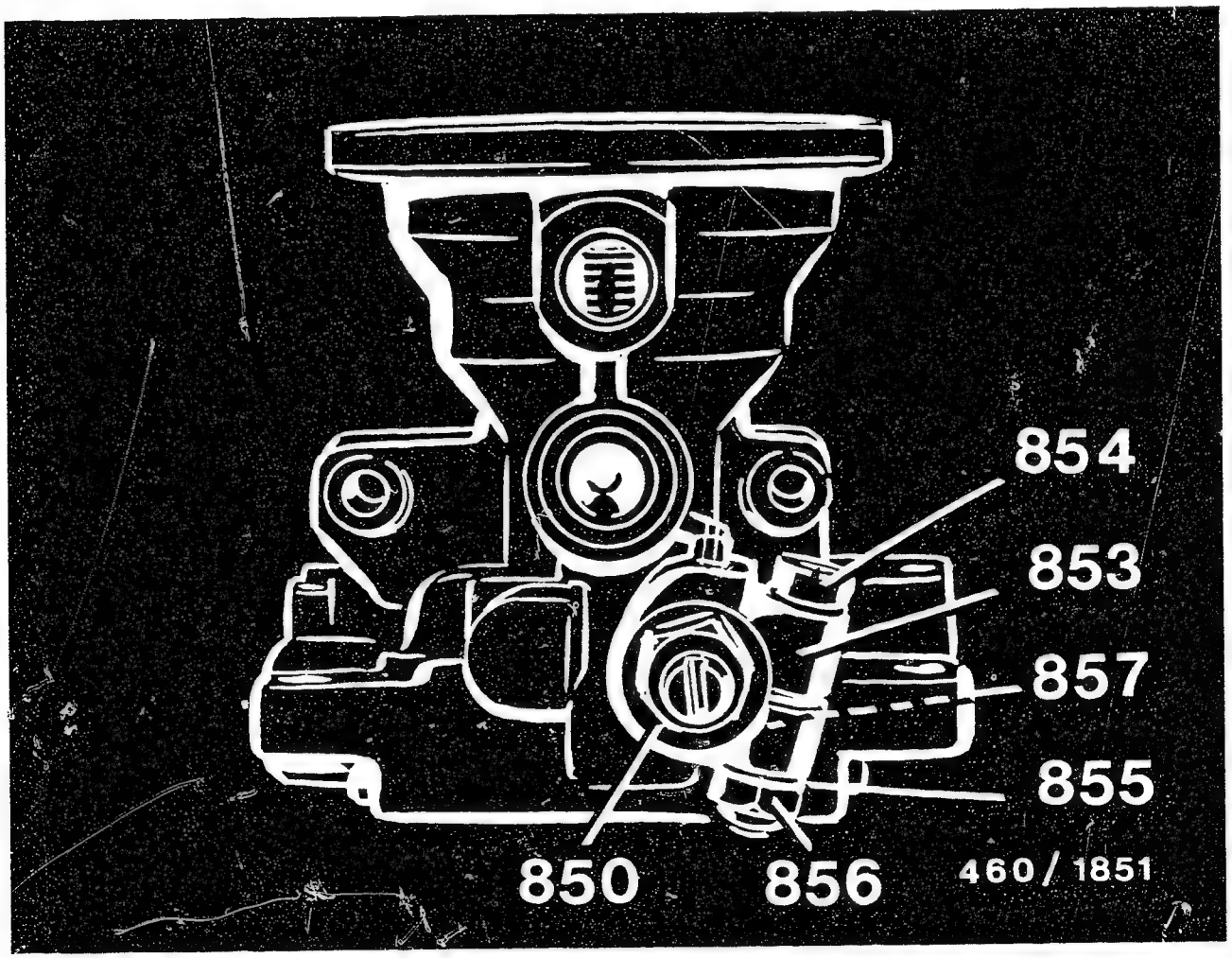
VE 6/10F 2300 R206 – 0 460 406 047 (BMW 324 d)

Workshop: EP
06.1988

Technical modification retaining part number

0089 En

As of date of manufacture FD 742 (2.87) the above-mentioned distributor-type fuel-injection pump was modified whilst retaining the part no. 0 460 406 047. Distributor-type fuel-injection pumps up to FD 741 (1.87) and as of FD 742 (2.87) are not interchangeable. Apart from the date of manufacture, the ext. charac. feature of the new dist.-type fuel-inj. pumps is that there is no ext. charac. full-load adjuster (see illustr.).



The various versions are indicated on the latest service-parts list with the service parts for the full-load adjuster being listed under the item numbers given in the illustration.

The test code for distributor-type fuel-injection pumps up to date of manufacture FD 741 (1.87) is given on the following pages in this service information.

The test code for distributor-type fuel-injection pumps as of FD 742 (2.87) can be found on the test-specification microcards WP.. The FD is indicated at the start of the test-specification sheet.

Only the latest distributor-type fuel-inj. pumps (as of FD 742) will be delivered for replacement purposes (index 090).

When replacing a distributor-type fuel-inj. pump with date of manufacture FD up to 741, flat-type pintle nozzles 0 430 250 148 (DN 0 SD 286) with an opening pressure of p ö = 130 bar have to be fitted, since otherwise complaints may be received on account of constant bucking when driving.

BOSCH-FUEL-INJECTION-PUMP TEST SPECIFICATIONS

Pay attention to information given in remarks column!

Test-specification sheet	: BMW 2.4 E
Edition	: 19.12.86
Supersedes	: 10.85
Test oil	: ISO 4113
Fuel-injection pump	: VE 6/10F2300 R206
Type number	: 0 460 406 047
Customer-specific data:	
Customer	: BMW
Engine	: M21D24W

TEST-BENCH PREREQUISITES

Test-oil return temperature >°C	
with thermometer >	: 40...48
electronic >	: 42...50
Supply pressure bar	: 0.2

Calibrating noz.-hold. ass. >		: 1 688 901 022
Opening pressure > bar		: 130 ... 133
Test pressure line		: 1 680 750 073
Outer diameter		: 6
x wall thickness >		: 2
x length >	mm	: 450

Fuel-injection pump settings
Check values in parentheses

Timing-device travel:

Engine speed	1/min	: 1500
Charge-air press.	hPa	: 500
Setting	mm	: 4.1...4.5
KSB sol. valve >	volts	: —

Supply pump pressure

Engine speed	1/min	: 1500
Charge-air press.	hPa	: 500
Setting	mm	: 5.9...6.5
KSB sol. valve >	volts	: —

Full-load delivery without charge-air pressure:

Engine speed	1/min	: 1250
Fuel delivery	cm3/	
>	1000 strokes	: 27.5...28.5
KSB sol. valve >	volts	: —
Scatter	cm3/	: 3.5
>	1000 strokes	: —

Idle speed regulation:

Engine speed	1/min	: 400
Charge-air press.	hPa	: 500
Fuel delivery	cm3/	
>	1000 strokes	: 6.0...10.0
KSB sol.-valve >	volts	: —

Scatter	cm3/	: 3.5
>	1000 strokes	: —

Full-load speed regulation:

Engine speed	1/min	: 2500
Charge-air pressure	hPa	: 500
Fuel delivery	cm3/	
>	1000 strokes	: 11.5...17.5
KSB solenoid valve >	volts	: —
Scatter	cm3/	: 5.0
>	1000 strokes	: —

Start:

Engine speed	1/min	: 100
Charge-air pressure	hPa	: —
Fuel delivery	min.	
>	cm3/1000 str.	: 45.0
KSB solenoid valve >	volts	: —
Scatter	cm3/	: —
>	1000 strokes	: 12.0

Fuel-injection-pump test specifications
Check values in parentheses

Timing-device profile:

1st engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 3.0...4.0
>	mm	: (2.8...4.2)
KSB solenoid valve >	volts	: 12.0
2nd engine speed	1/min	: 1000
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 4.5...5.5
>	mm	: (4.3...5.7)
KSB solenoid valve	volts	: 12.0
3rd engine speed	1/min	: 750
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 0.8...1.6
>	mm	: (0.5...1.9)
KSB solenoid valve >	volts	: —

4th engine speed	1/min	: 1500
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: —
>	mm	: (3.6...5.0)
KSB solenoid valve >	volts	: —
5th engine speed	1/min	: 2000
Charge-air pressure	hPa	: 500
Timing-device travel	mm	: 6.1...6.9
>	mm	: (5.8...7.2)

Supply-pump pressure profile:

1st engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
Supply pump pressure >	bar	: 3.1...3.7
KSB solenoid valve >	volts	: —
2nd engine speed	1/min	: 2000
Charge-air pressure	hPa	: 500
Supply pump pressure >	bar	: 7.2...7.8
KSB solenoid valve >	volts	: —

Overflow quantity at overflow valve:

1st engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
KSB solenoid valve >	volts	: —
Overflow quantity >	cm3/10	: (26...98)
2nd engine speed	1/min	: 2300
Charge-air pressure	hPa	: 500
KSB solenoid valve >	volts	: —
Overflow		: 55...138
quantity >	cm3/10	: (40...153)

Fuel-delivery and regulation characteristics:

1st engine speed	1/min	: 1250
Charge-air-press. adj. pt.>	hPa	: 120
LDA stroke	mm	: 5.0
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: 23.2...26.7
	1000 strokes	: (22.7...27.3)
2nd engine speed	1/min	: 2650
Charge-air pressure	hPa	: 500
KSB solenoid valve >	volts	: —

Fuel delivery	cm3/	: ——
>	1000 strokes	: 0...6.0
3rd engine speed	1/min	: 2500
Charge-air pressure	hPa	: 500
KSB solenoid valve>	volts	: ——
Fuel delivery	cm3/	: ——
>	1000 strokes	: (10.5...18.5)
4th engine speed	1/min	: 2300
Charge-air pressure	hPa	: 500
KSB solenoid valve	volts	: ——
Fuel delivery	cm3/	: 26.2...29.2
>	1000 strokes	: (25.4...30.0)
5th engine speed	1/min	: 1750
Charge-air pressure	hPa	: 500
KSB solenoid valve>	volts	: ——
Fuel delivery	cm3/	: 28.8...32.2
>	1000 strokes	: (28.2...32.8)
6th engine speed	1/min	: 1250
Charge-air pressure	hPa	: -100
KSB solenoid valve>	volts	: ——
Fuel delivery	cm3/	: 22.0...24.0
>	1000 strokes	: (20.7...25.3)
7th engine speed	1/min	: 1250
Charge-air pressure	hPa	: 120
KSB solenoid valve	volts	: ——
Fuel delivery	cm3/	: 23.3...26.7
>	1000 strokes	: (22.7...27.3)
8th engine speed	1/min	: 1250
Charge-air pressure	hPa	: 500
KSB solenoid valve>	volts	: ——
Fördermenge	cm3/	: ——
>	1000 strokes	: (25.7...30.3)
9th engine speed	1/min	: 500
Charge-air pressure	hPa	: 500
KSB solenoid valve>	volts	: ——
Fuel delivery	cm3/	: 27.5...30.5
>	1000 strokes	: (26.0...32.0)
Zero delivery (stop):		
Mech. shutoff:		
Engine speed	1/min	: ——
Fuel delivery	cm3/	: ——
>	1000 strokes	

Electric shutoff:		
Engine speed	l/min	: 400
ELAB	volts	: —
Fuel delivery	cm3/	: —
>	1000 strokes	
Idle delivery:		
1st engine speed	l/min	: 400
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: (4.0...12.0)
2nd engine speed	l/min	: 450
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: —
>	1000 strokes	: 0...6.0
Automatic starting quantity:		
1st engine speed	l/min	: 200
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: 42.0...52.0
min. >	1000 strokes	: —
2nd engine speed	l/min	: 400
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: 25.0...35.0
max. >	1000 strokes	: —
3rd engine speed	l/min	: 480
KSB solenoid valve >	volts	: —
Fuel delivery	cm3/	: 21.7...26.3
>	1000 strokes	: —
Shutoff solenoid:		
Cut-in voltage min. >	volts	: 10.0
Rated voltage	volts	: 12.0

Installation and adjustment dimensions:

Designation		
K	mm	: 3.2...3.4
KF	mm	: 6.4...6.6
MS	mm	: 1.4...1.6
SVS max.	mm	: 3.9
XK	mm	: 17.0...19.0
XL	mm	: 9.6...13.0

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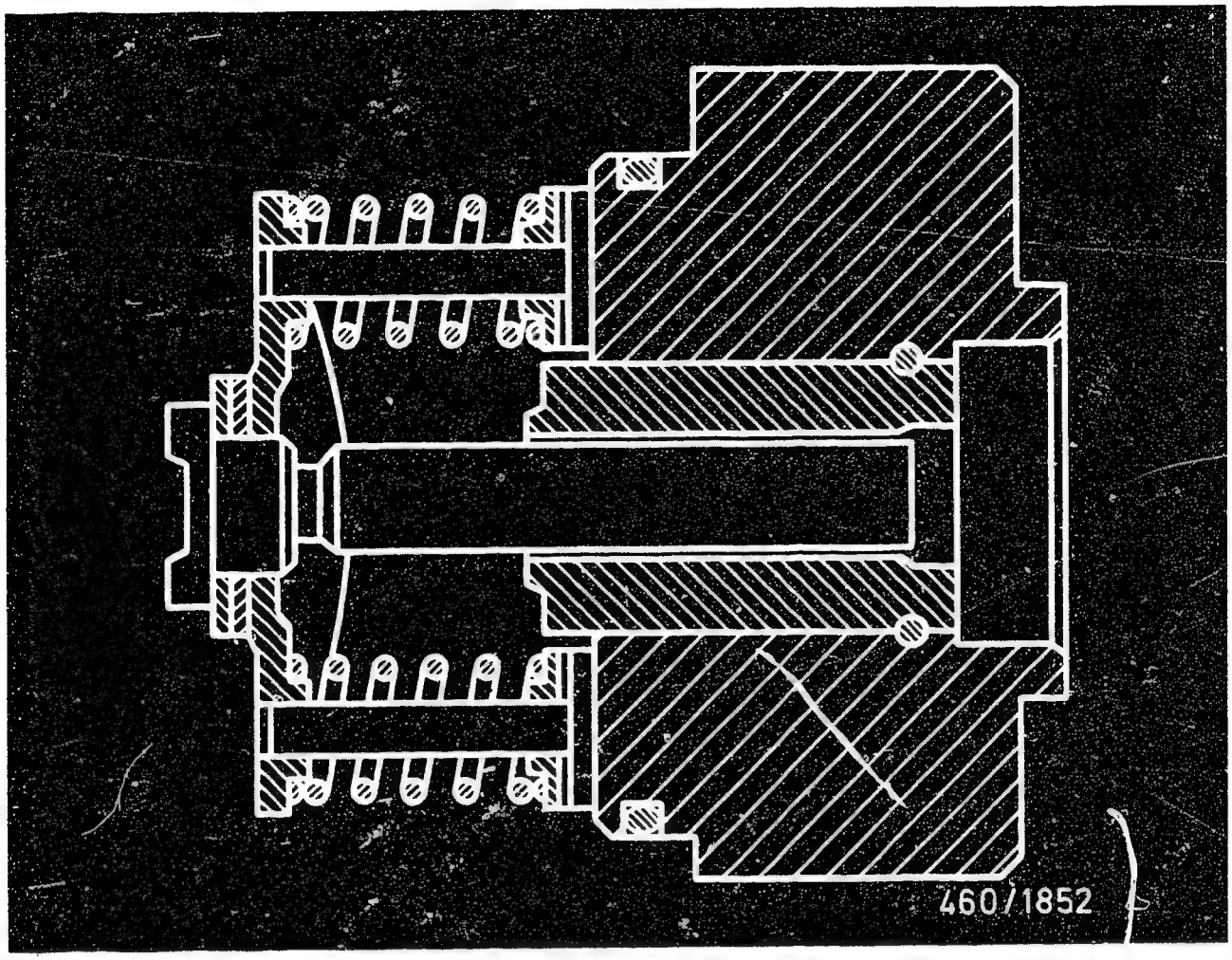
On distributor-type fuel-injection pumps installed in vehicles with direct injection (DI) engines the plunger-return-spring assembly is calibrated in series production with a certain force in the TDC (top dead center) position of the distributor-pump plunger.

These pump versions can be identified from the fact that the KOT is quoted in the corresponding test-specification sheet instead of the KF adjustment dimension.



The adjustment method using the KF dimension cannot be employed with these pump versions.

If repairs are necessary, the distributor head with calibrated plunger-return-spring assembly is replaced (picture).

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IN-LINE FUEL-INJECTION PUMP, SIZE P

Workshop: EP
05.1988

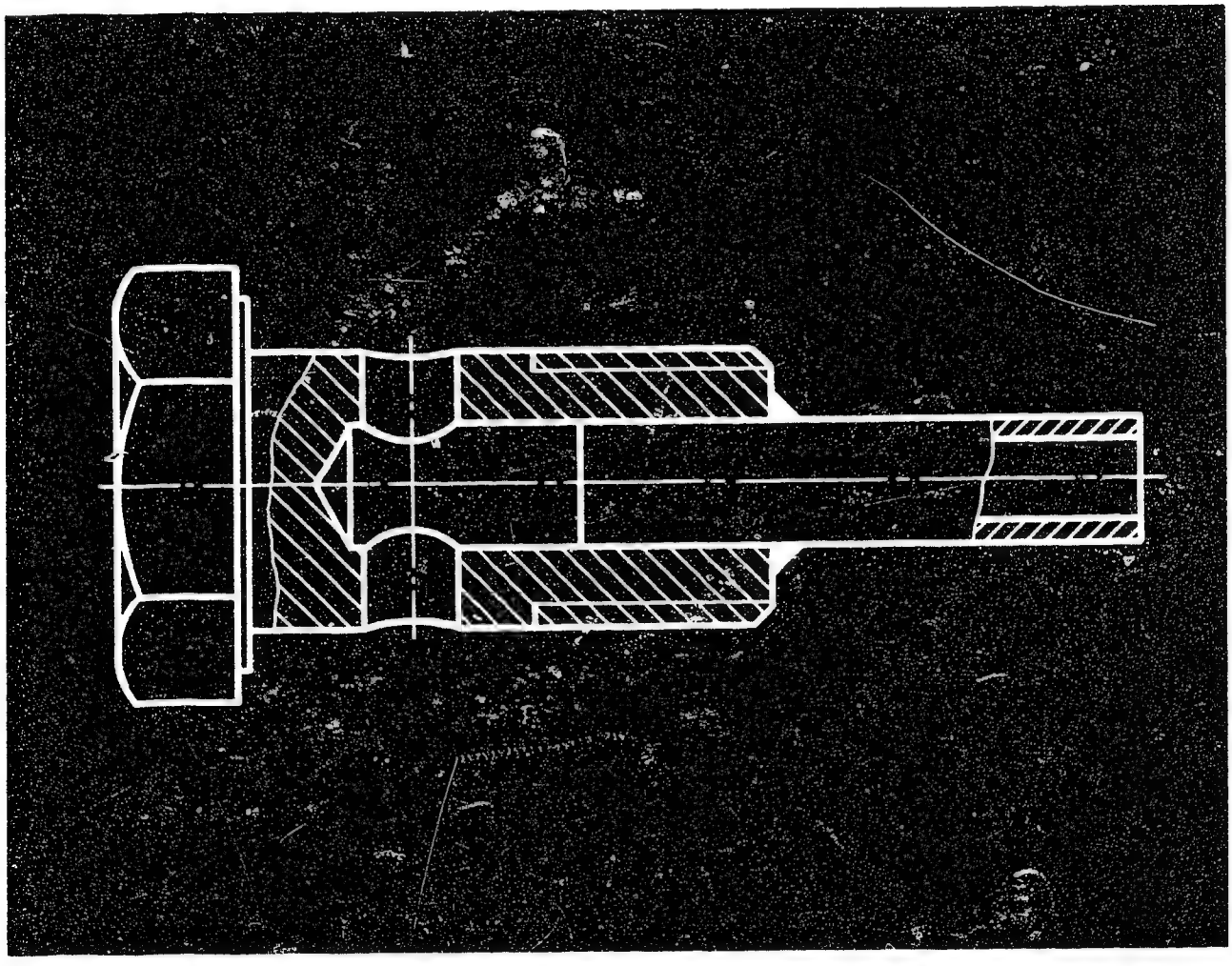
Complaints stemming from seizure of roller tappets on Iveco vehicles

0099 En

Complaints stemming from seizure of roller tappets may be encountered on Iveco vehicles with the following in-line fuel-injection pumps

PE 6 P 120 A 720 RS 3069 – 0 411 826 712
RS 3123 – .. 731
RS 3192 – .. 761
RS 3195 – .. 762

To avoid such complaints, a special banjo bolt (see Fig.) is to be installed in the lube oil return of the fuel-injection pump.



This measure increases the oil level in the fuel-injection pump and guarantees a supply of oil in any operating situation.

The special banjo bolt can be ordered from Iveco under part no. 483 3934.

The following is to be noted when using the special banjo bolt:

* For fuel-injection pumps up to date of manufacture 746 (June 87) the existing screw-thread insert (Heli-coil) must be carefully bent aside (not in the direction of the pump interior), so as to enable the bolt to be fitted.

* As of date of manufacture 746 there is no screw-thread insert in the pump housing.

* When disassembling the fuel-injection pump, care is to be taken to ensure that the bolt is removed before removing the camshaft.

The costs of installation are to be charged to the customer, since complaints which can be attributed to lack of oil do not represent a warranty situation.

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ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service Department (KH/VKD 2)

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DISTRIBUTOR-TYPE FUEL-INJECTION PUMP VE..F..

Workshop: EP
05.1988

New lubricant for control-lever-shaft bearings on distributor-type pumps

0100 En

To increase the service life of the control-lever-shaft bearings on distributor-type pumps, the shafts must be greased prior to fitting with Molykote grease Q5-7544.

The use of this lubricant reduces wear on the bearings and guarantees freedom from leaks for a longer period.

The Molykote grease Q5-7544 can be ordered in 50 g tubes.

Part No. 5 994 420 005

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DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS VE..F..

Workshop: EP
05.1988

Leaking bushing in housing cover

0101 En

On distributor-type fuel-injection pumps VE..F.. leaks may occur at the housing cover between the bronze bushing and the control lever shaft.

A wider range of steel bushings is now available for repairing the housing covers.

Steel bushings:

Length	Part No.	
19.9 mm	1 460 324 315	(known)
24.4 mm	1 460 324 316	(known)
30.6 mm	1 460 324 333	(new)
35.1 mm	1 460 324 332	(new)
40.6 mm	1 460 324 331	(new)

The listed bushings can be fitted as described on microcard W-460/100.

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DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS VE..F..
WITH MANIFOLD-PRESSURE COMPENSATOR (LDA)

Workshop: EP
05.1988

LDA stroke adjustment with new tool

0102 En

With certain distributor-type fuel-injection pumps VE..F.. with LDA it is no longer possible to carry out calibration of the LDA stroke described in W 460/100 using the measuring sleeve KDEP 1105.

This is due to the height of the measuring sleeve which is in excess of the design-related maximum stroke of the LDA.

When calibrating the LDA stroke (H) on these pumps use must be made of the new measuring sleeve KDEP 1157.

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Work units for add-on modules

The work units for add-on modules listed below shall apply provisionally until incorporated into the next edition of the DAT-BOSCH work units.
They do not contain the necessary work units for testing pump and governor.

Add-on module VE..F..pump	Removal, disassembly, cleaning, repair, assembly, adjustment Work units (WU)	Testing and adjustment in fitted condition Work units (WU)
Cold-start injection advance (hydraulic) (KSB)	4	4
Manifold-pressure compensator + cold-start injection advance (LDA + KSB)	16	10
Idle spring fixed in housing + cold-start injection advance (LFG + KSB)	6	7
Manifold-pressure compensator (external attachment) (LDA)	12	12
Temperature-controlled idle-speed increase + cold-start injection advance (TLA + KSB)	7	—
Hydraulically operated torque control + cold-start injection advance (adjustable) (HBA + KSB)	13	16
Idle spring fixed in housing LFG	6	5

FUEL-INJECTION-PUMP COMBINATIONS (IN-LINE PUMPS)

Add-on module	for pump	for governor	Removal, disassembly, cleaning, repair, assembly, adjustment Work units (WU)	Testing and adjustment in fitted condition Work units (WU)
LDA, pump end	P	RQ, RQV	5	5
Altitude-pressure compensator (ADA)	M	RSF	–	6
Altitude-pressure and manifold-press. compensator (ALDA)	MW	RW	4	8
Electronic idle-speed control (ELR)	M	RSF	4	3
Start-of-delivery sensor (FBG)	M	RSF	4	3
Manifold-pressure compensator (2 stages)	P	RQ, RQV	6	9
Manifold-pressure compensator (horizontal)	A	RQV	5	4
Manifold-pressure compensator (horizontal)	MW	RQV	5	4
Manifold-pressure compensator (horizontal)	P	RQ	5	4
Manifold-pressure compensator (vertical)	A	RSV	4	5
Manifold-pressure compensator (vertical)	MW	RQV	5	3
Manifold-pressure compensator (vertical)	P	RSV	4	5

Add-on module	for pump	for governor	Removal, disassembly, cleaning, repair, assembly, adjustment Work units (WU)	Testing and adjustment in fitted condition Work units (WU)
Pneumatic idle-speed booster (PLA)	M	RSF		3
Control-rod travel sensor (RWG)	M	RSF	4	4

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VE DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS

Workshop: EP
06.1988

Calibrated fittings

0108 En

Calibrated fittings are being installed, so as to reduce delivery fluctuations at the high-pressure outlets of VE distributor-type fuel-injection pumps.

Such fittings have already been installed since mid 1987 on pump versions used for example by BMW, Peugeot and Volvo.

As opposed to previous fittings, the delivery-valve assemblies cannot be replaced.

Calibrated fittings are to be renewed as a set and appear in the service-parts list as a group.

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RQ(V) GOVERNOR WITH 13 mm SLIDING-SLEEVE TRAVEL

Workshop: EP
06.1988

Alteration to important functional dimensions,
repair instructions

0109 En

The RQ(V) governor with 13 mm measuring element has the following advantages over the RQ(V) governor with 11 mm measuring element:
* Less pronounced speed droops
* Favorable control-lever position breakdown over engine speed and torque-control rate.

The following design changes have been made:
* The initial position of the flyweights has been moved inwards by 2 mm
* The installation position of the template (plate cam) has been altered.

Dimensional changes have been made to which attention must be paid when assembling the governor following repair. These changes supplement the corresponding sections of the microcard W-420/104.

The slider dimension has been changed from:
34.8 mm ... 35.2 mm (11 mm measuring element) to
35.8 mm ... 36.2 mm (13 mm measuring element).

The template (plate cam) spacing has been changed from:
24.4 mm ... 24.6 mm (11 mm measuring element) to
23.7 mm ... 23.9 mm (13 mm measuring element).

There is no external difference between the various versions (governor with 11 mm measuring element or 13 mm measuring element). As an aid to differentiation, the following note is to be incorporated into the corresponding test-specification sheet in the column "remarks": Governor with 13 mm measuring element.

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INJECTION-PUMP ASSEMBLIES 0 402 678 800/ ..801
IN SCANIA ENGINES DS 1440, 1442, 1442-Case,
DSI 1440, 1441

Workshop: EP
08.1988

0110 En

Alteration to camshaft and flyweight assembly

The injection-pump assemblies

PE 8 P 120 A 920 / 4 LS 7002
and ..7002-1 with

EP/RSV 350 ... 1100 P1/484
and ... 1050 P1/504

were occasionally subject to camshaft fracture.

This fault can no longer occur as a result of design improvements made on the camshaft (no Woodruff key) and the use of a flyweight assembly with vibration damper.

As of date of manufacture, December 1986 (FD 652) the camshaft 2 416 158 065 thus became 2 416 158 111 and the flyweight assembly 1 428 194 019 (without vibration damper) became 2 428 194 012 (with vibration damper).

Use may only be made of the new camshaft and the new flyweight assembly if spares are required when performing work on the above-mentioned injection-pump assemblies.

The following parts are also subject to change when performing conversion work:

Item 1/ 1	Governor housing previously	2 425 151 001 now 2 425 151 079
Item 58/ 1	Woodruff key	1 900 023 007 deleted
Item 62/ 1	Retainer	2 916 600 006 new
Item 66/ 1	Needle-roller bearing	1 420 920 008 new
Item 68/ 1	Sliding sleeve previously	1 420 322 026 now 1 420 505 055
Item 71/ 1	Supporting plate	1 420 101 078 new
Item 71/01	Supporting plate	9 420 270 013 new
Item 71/02	Supporting plate	9 420 270 014 new
Item 71/03	Supporting plate	9 420 270 015 new
Item 71/04	Supporting plate	9 420 270 016 new
Item 32/ 1	Fork lever previously	1 421 933 048 now 9 420 270 011

The previous versions of the camshaft and flyweight assembly without vibration damper remain valid for other applications.

For engines up to and including date of manufacture 651, the usual warranty periods are to be extended by a further year and the maximum number of operating hours covered by goodwill is being increased from 2400 h to 3000 h. This goodwill provision applies only to the camshaft.

Please check your stocks and order the new parts as applicable by the usual means.

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TDZ NOZZLE-HOLDER ASSEMBLY WITH BOSCH INJECTION NOZZLE

Workshop: EP
08.1988

for Mercedes-Benz Transporter MB 100 D

0111 En

Daimler-Benz is marketing its new Transporter MB 100 D with OM 616 (53 kW) engine and the following fuel-injection equipment:

Fuel-injection-pump combination	:	M-pump with RSF governor
for the Spanish market	:	TDZ (Talleres Diesel Zaragossa)
for the European market	:	BOSCH injection-pump assembly 0 400 074 924

Pump	PES 4 M 55C 320 RS,	0 410 054 963
Mechanical governor	RSF 375/2200 M 12-1,	0 420 021 064
Supply pump	FP/K 22 M 101,	0 440 007 017

Nozzle-and-holder assembly for all vehicles:
TDZ-KCA holder with

Bosch flat-type pintle nozzle	DN 0 SD 261,	0 434 250 120

The design of the TDZ nozzle-holder assembly is the same as that of the

Bosch nozzle-holder assembly	KCA 30 S 44,	0 430 211 053

Like all non-Bosch products, TDZ products are not subject to BOSCH warranty provisions. This also applies to the TDZ nozzle-holder assembly. The warranty procedure for the nozzle-and-holder assembly is therefore handled by the Mercedes-Benz After-Sales Service Division.

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Technical After-Sales Service (KH/VKD 2)

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ELECTRONICALLY CONTROLLED DIESEL FUEL INJECTION (EDC)
FOR MERCEDES-BENZ COMMERCIAL VEHICLES
(Daimler-Benz system designation: EDR)

Workshop: EP
09.1988

0122 En

Procedures for after-sales service

1. General

Since the end of 1987, Daimler-Benz has been offering a Bosch electronically controlled diesel fuel-injection system for its commercial vehicles as special equipment for its diesel engines.

This applies to the following types of vehicle:

1644, -S and -LS
1944, -S and -LS
2244, -S and -L
2644 S *)

with engines OM 442 LA, model 442.980.

*) Not in connection with converter and clutch unit

These vehicles will first be available in Germany and then subsequently also in the rest of Europe.

Reliable and rapid after-sales service is of major importance as regards market penetration particularly when new systems are launched.
This Service Information is designed to provide all diesel after-sales-service workshops with information on how to handle after-sales-service work on Mercedes-Benz commercial vehicles with electronic diesel control (EDC).

2. After-sales-service workshops

After-sales service is initially to be limited to Europe.
Please address enquiries regarding after-sales-service procedures for Mercedes-Benz EDC systems to the central after-sales-service department of your BOSCH representative.

3. After-sales services

3.1 After-sales service for vehicle:

The after-sales-service workshops listed under item 2 have facilities for on-the-vehicle trouble-shooting.
Diagnosis is effected by way of an EDC-system flashing code and/or using special trouble-shooting instructions which contain all the necessary test specifications.
Faulty components are to be replaced. Repair is not initially envisaged.

3.2 After-sales service for injection-pump assembly:

Fuel-injection pumps with electrohydraulic positioner (governor) can be tested at the after-sales-service workshops indicated in item 2.
The test results are recorded in the BOSCH test record for fuel-injection pumps.
Repairs to the injection-pump assembly are not envisaged in the initial phase.
External leaks at the fuel-injection pump (e.g. leaking delivery-valve holder), which do not require assembly work on the hydraulic positioner, can however be eliminated.

4. After-sales-service tools

4.1
A special portable test set KDEP-K 500, which is available at the main after-sales-service workshops in Hamburg, Cologne, Munich and Karlsruhe, has been developed for on-the-vehicle testing. The other after-sales-service centers will be supplied via the above.

Further testers, aids and tools for on-the-vehicle trouble-shooting are listed in the trouble-shooting instructions which the main after-sales-service workshops have at their disposal.

4.2
The fuel-injection pumps with electrohydraulic governor are to be tested with test equipment which also includes a portable test set KDEP-K 400.
This portable test set is likewise in the possession of the main after-sales-service workshops in Hamburg, Cologne, Munich and Karlsruhe. If required, other after-sales-service offices can obtain the portable test set via the above.

The test instructions outline the remaining test equipment not contained in the portable test set.

5. Service-part supply

The BOSCH service organization can purchase service parts and products in the usual manner. All system components are on stock in the Sales Center in Karlsruhe and can be sent overnight if necessary to any BOSCH Service Station in West Germany. This presupposes that an order has been submitted to KH/ALP3 by 17.00 hours on a given working day.

The main after-sales-service workshops in Hamburg (Kruse), Cologne (Diesel-Sepp, Hürth) and Munich are likewise in possession of a set of EDC components which can be rapidly made available if required.

France (BS direct delivery), Austria (RBOS Vienna), Switzerland (BS direct delivery), Holland (Willem van Rijn, Amsterdam) and Italy (RBIT Milan) can be supplied within 24 hours from the Sales Center in Karlsruhe. Our representatives in other countries will be providing a central service-parts supply for their service organization.

6. Technical documentation

* Equipment data:	Microcard A ..
* Service part lists for nozzle-and-holder assembly:	Microcard EP ..
* Vehicle test:	Tr.-shooting instruc. with test specific.
* Pump test:	Test instruc. with test specifications

Distribution of the trouble-shooting instructions for the vehicle and the test instructions for test-bench testing of the fuel-injection pump was restricted to the main after-sales-service workshops outlined in item 2.

7. Training

Staff from the main after-sales-service workshops have been trained on the EDC system for Mercedes-Benz commercial vehicles at the BOSCH After-Sales Service Training Center in Wernau (KH/VSK). In addition to the theoretical side, the training course involved practical on-the-vehicle trouble-shooting and testing of the injection pump assembly on the pump test bench.

Training with the same content has been provided for European trainers from our various country representatives.

Further training will be offered in line with market requirements.

6. Warranty procedure

Warranty assessment and procedure for Mercedes-Benz EDC components will be handled exclusively via the main after-sales-service workshops indicated in item 2. Products found to be faulty during trouble-shooting and testing are always to be sent to the address indicated on the "delivery note for the return of products about which complaints have been received" (KH/VKD3-15 333-2).

This does not however apply to fuel-injection pumps with external leaks (e.g. leaking delivery-valve holder) which can be rectified without the need for assembly work on the hydraulic positioner. Delivery corrections are also permissible (see test instructions).

The credit for the product replaced for the customer under warranty will be handled in the usual way following receipt of the warranty claim.

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Divison KH
Technical After-Sales Service (KH/VKD 2)

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The testing of nozzle-and-holder assemblies is described in the test instructions VDT-W-430/500 on the microcard SIS-ALL-505. Incorrect assessments during the incoming inspection have recently become more frequent.

The following have been incorrectly assessed:

* Leakage
* Spray pattern
* Chatter.

The nozzle-and-holder assembly must be cleaned prior to testing so as to increase assessment reliability. The previously prescribed cleaning of the nozzles with a brass brush is no longer sufficient.

Cleaning in an ultrasonic bath creates the necessary prerequisites for correct nozzle testing (see below for recommended equipment).

Test instructions

Nozzles already found to be faulty (e.g. broken pintle) during the visual inspection need not be subjected to further testing.
Nozzles cleaned in an ultrasonic bath are to be inspected according to the same test criteria as those prescribed in the test instructions SIS-W-430/500.

Particular attention is to be paid to the following:

As regards the spray produced, flat-type pintle nozzles are to be assessed differently to throttling-pintle nozzles. They have a one-sided, oval type of spray.

Nozzles designated e.g. DN 12.. (12° spray-dispersal angle) are to be assessed differently to DN 0..(0° spray-dispersal angle). Only DN 0.. features a closed spray.

Leakage is not to be assessed together with chatter and/or spray testing.

When testing chatter, attention is to be paid to the different prescribed test speeds for used and new nozzles.

The characteristic chatter group of a hole-type nozzle is to be taken from the new test-specification microcard WP-430 .

Repair

When carrying out repairs (disassembly/assembly) on nozzle-and-holder assemblies, neither nozzles nor parts of the nozzle-holder assemblies may be lapped and it is not permissible to make use of an emery cloth or steel brushes. It must also be ensured that the nozzle body and nozzle valve of a nozzle remain together and that they are not interchanged with parts belonging to other nozzles. This likewise applies if nozzles about which complaints have been received are submitted for assessment (not bulk goods).

Cleaning of nozzles/nozzle-and-holder assemblies prior to testing

When assembling nozzle-and-holder assemblies, all parts must be cleaned beforehand. There must be no damage to sealing surfaces.
Damaged parts are to be replaced with new ones.

Ultrasonic cleaning

For ultrasonic cleaning purposes, use is to be made of the ultrasonic cleaner KDAW-R 100 with insert basket and cover. The recommended cleaning agent is the alkaline cleaner KDHS-0010.

The following instructions are to be observed:

1. Use is to be made of acid-resistant gloves and protective goggles.

2. The cleaning fluid is to be diluted with water in a volume ratio of 1 : 20.

3. Heat up cleaning bath to approx. 45° C.

4. Place nozzle-and-holder assembly as upright as possible in insert basket with nozzle facing downwards.

5. The cleaning time depends on the degree of contamination, but should be at least 10 minutes.

6. Immediately after cleaning, the parts are to be rinsed in a cold cleanser, blown dry using compressed air and dipped in calibrating oil.

7. The nozzle-and-holder assembly is then to be rinsed through on a manual test bench.

8. When cleaning nozzles, pull needle valve completely out of body and clean both parts separately. In doing so, the nozzle body is to be cleaned in an as upright a position as possible with the holes facing downwards. Cleaning time at least 5 minutes.

9. Care is to be taken to ensure that the needle valve and body do not become mixed up with parts from other nozzles. Subsequent treatment as described under item 6.

10. The cleaning fluid is to be changed as required. If nozzle-and-holder assemblies are extremely contaminated, one fill is sufficient for between 15 and 20 nozzle-and-holder assemblies and between 10 and 15 nozzles.

11. Disposal:
Neutralize if a system is available.
If no neutralization system is available, used cleaning fluid must be disposed of as special waste by an approved specialist company (refuse code no. 52402).
Outside Germany the respective refuse disposal regulations apply.

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IN-LINE PUMP PES 6A 90D 410 RS 2710 Workshop: EP
10.1988

Cold-starting problems
MB Trac 1000, 1100, Unimog U 1000 0131 En

In the case of MB Trac 1000, Trac 1100 and Unimog U 1000 with injection-pump combination:

0 400 876 335 – PES 6A 90D 410 RS 2710
RSV 350...1200 A1C 1154 L or
0 400 876 336 – PES 6A 90D 410 RS 2710
RSV 350...1200 A1C 1154 – 1L

and date of manufacture up to 844 (April 88), complaints may be received regarding cold-starting problems at temperatures below 0° C.

The following measures are to be implemented as a remedy:

* Starting fuel delivery, inc. to 85...95 cm3/1000 strokes

* Replacement of standard tension spring 1 424 650 061 with tension spring 1 424 650 063.

* Replacement of plunger-and-barrel assemblies 1 418 325 145. Use may only be made of plunger-and-barrel assemblies with date of manufacture as of 843 (March 88).

This complaint can no longer arise in the case of injection-pump combinations with dates of manufacture as of 845 (May 88), since the above-mentioned remedial measures have been introduced as standard.

Within the warranty period, the necessary work is to be performed for customers free of charge.

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SERVICE PROCEDURE FOR
FUEL-INJECTION-PUMP VARIANTS

Workshop: EP
11.1988

0134 En

GENERAL

In order to increase delivery flexibility, our customers have for some time been procuring so-called basic pumps which are then converted to form a variant by modifying an adjustment and/or by changing a component.

Basic pumps are series pumps which can be recognized in the usual manner from the type designation and the 10-digit part no. on the nameplate.

Pumps are referred to as variants if customers (vehicle or engine manufacturers) produce them themselves by altering a setting and/or by changing a component (e.g. different shutoff solenoid).

Bosch does not itself produce any variants, which means that if a variant has to be replaced, then this must be produced by modifying the corresponding basic pump.

Fuel-injection-pump variants are not to be confused with trial pump assemblies (V-numbers). Our after-sales service still does not have any service-parts lists or test specifications for trial pumps.

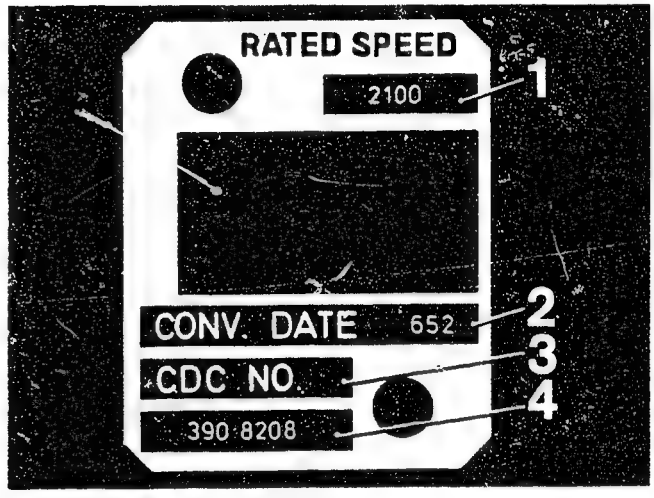
DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS

Distributor-type fuel-injection pumps feature an auxiliary nameplate which not only indicates the date of manufacture of the variant, but also the customer number (identification number) and the customer's symbol (or customer's name).

Example:

Variant auxiliary nameplate of vehicle or engine manufacturer.

1 = New rated speed
2 = Date of manufacture (MD) of variant
3 = Customer's trademark
4 = Customer's part number of variant



IN-LINE PUMPS

In-line pump variants have a maximum of 2 code letters behind the 10-digit BOSCH part number of the pump assembly.

Example: Basic assembly: 0 401 846 544
Variant: 0 401 846 544 A

As regards in-line pumps, variants can also be provided with an aux. nameplate which then features the same information as that described above for distributor-type fuel-inj. pumps.

The engine-speed, delivery and full-load stops are secured with lead seals of the vehicle and/or engine manufacturers. If BOSCH Service effects conversion on a customer's behalf, then these variants are provided with the usual lead service seal.

SERVICE PROCEDURE FOR FUEL-INJECTION-PUMP VARIANTS

After-sales service is provided for fuel-injection-pump variants in the same manner as for basic pumps (series pumps).

REPAIRS TO FUEL-INJECTION-PUMP VARIANTS

Repairs to fuel-injection-pump variants are based on the corresponding repair instructions for the basic pump (see SIS Microcard W-400/000).

A check must be made by way of the serv.-parts list to establish whether the scope of service parts has been altered or supplemented, since it is not possible to tell by looking at a pump whether it is a conversion and/or an adjustment variant.

If applicable, changes to the scope of service parts are indicated on the service-parts list of the basic pump under the items 960/01... 969/99. It is thus possible to use the service-parts list of the basic pump to establish whether the variant contains different components to the basic pump. In the case of in-line pump assemblies, not only the serv.-parts list of the pump, but also the serv.-parts list of the governor is to be exam. for an extended or modified parts scope.

Serv.-parts lists of the basic pumps are determ. as is standard procedure by way of the Table of Contents EP 00 or EP 01.

TESTING OF FUEL-INJECTION-PUMP VARIANTS

The testing of fuel-injection-pump variants is based on the corresponding test instructions for the basic pump (see SIS Microcard W-400/000).

As is the case for basic pumps, test specifications for fuel-injection-pump variants are determined by way of the test-specification Table of Contents WP 00 or WP 01..

The respective variant of a distributor-type fuel-injection pump is listed together with its customer part no. (identification number) in the table of contents.

In-line pump variants can be recognized by way of the maximum of two code letters behind the 10-digit BOSCH part no. of the assembly in the Table of Contents WP 00 or WP 01.

WARRANTY PROCEDURE

The warranty procedure for fuel-injection-pump variants takes the usual form in the event of proven material and/or production shortcomings.

Adjustment errors on fuel-injection-pump variants with lead seals of the vehicle and engine manufacturers are not covered by warranty and BOSCH does not provide reimbursement.

The usual Bosch Service Warranty does however apply to variants manufactured by the BOSCH Service network.

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Mechanical load impact damping (MLD)
Spring-type load impact damping (FLD)

GENERAL

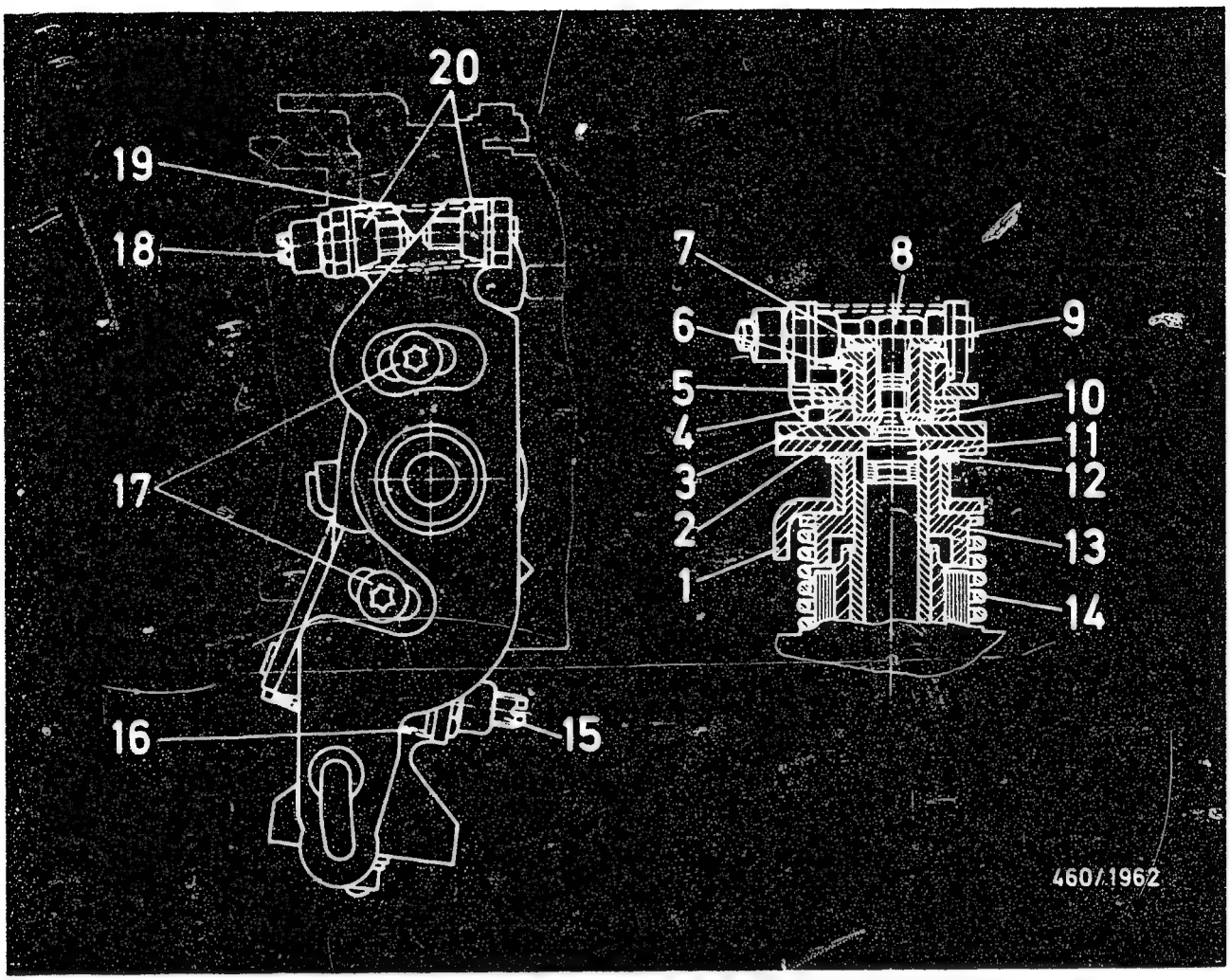
To avoid the load impact (change of engine contact side in engine mounts) on transition from overrun to load, distributor-type fuel-injection pumps are fitted with

- mechanical load impact damping and
- spring-type load impact damping.

Used in:

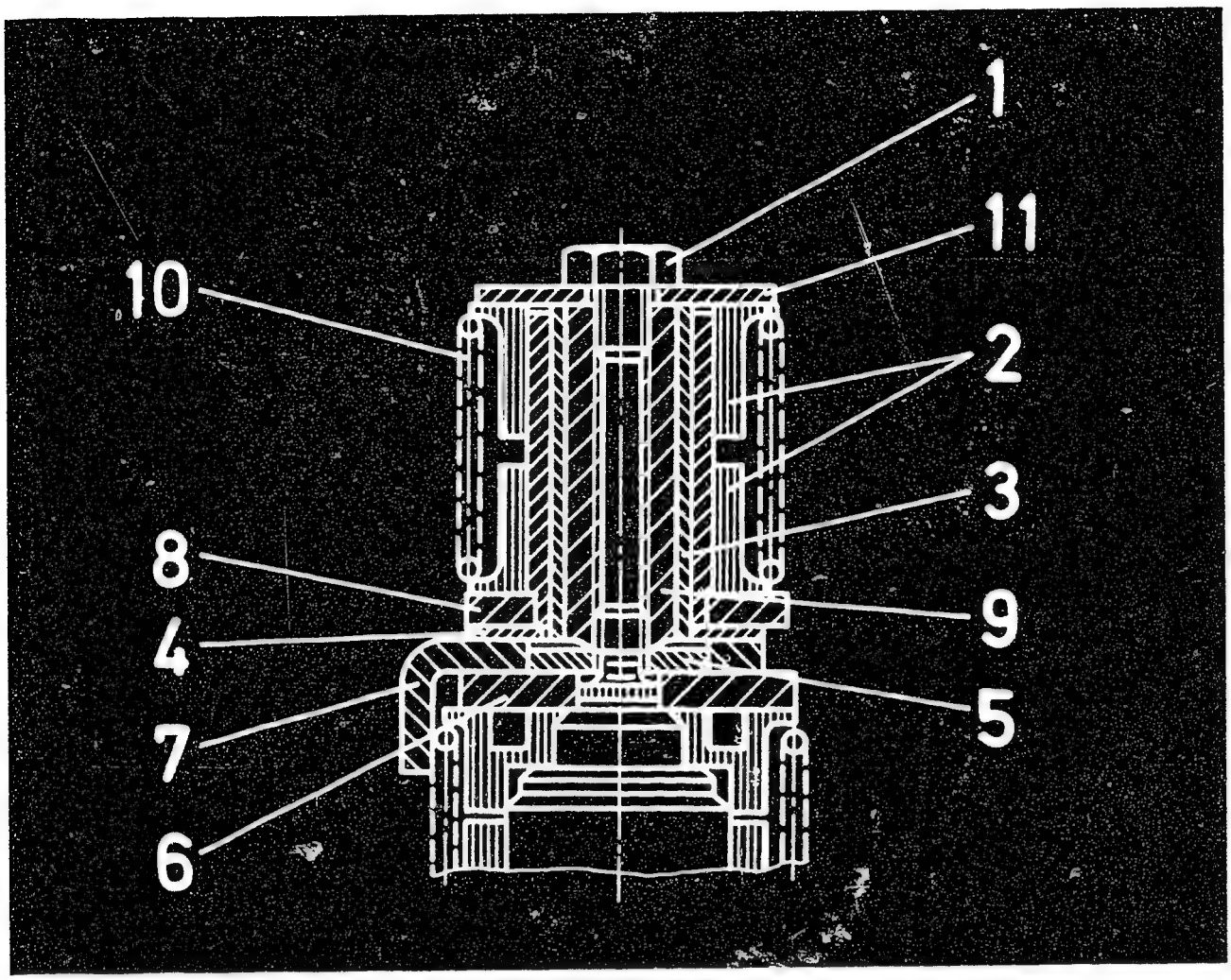
Audi 80 Turbo as of 05.88
- Mechanical load impact damping

VW Passat Turbo as of 06.88
- Spring-type load impact damping



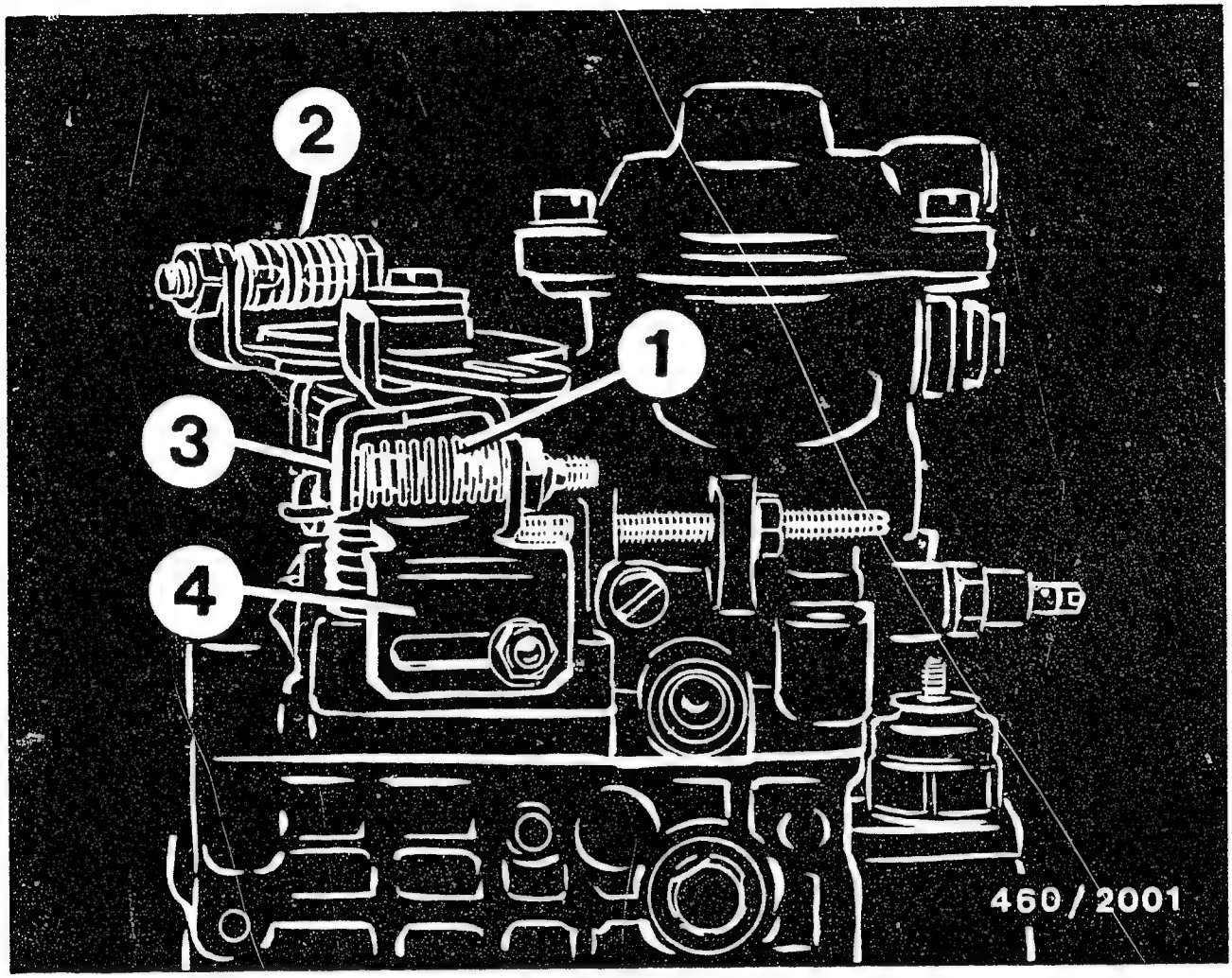
1 = Intermediate lever
2 = Clamping lever
3 = Adjusting lever
4 = Plain washer
5 = Control lever
6 = Intermediate bushing
7 = Connecting nut
8 = Hexagon nut
9 = Plain washer
10 = Shim
11 = Part-load regulator
12 = Plain washer
13 = Spring seat
14 = Cyl. helical coiled spring
15 = Headless setscrew
16 = Compression spring
17 = Torx bolt
18 = Headless set screw
19 = Compression spring
20 = Spring seat

INDIVIDUAL COMPONENTS OF MECHANICAL LOAD IMPACT DAMPING (MLD)



1 = Hexagon bolt
2 = Spring seat
3 = Intermediate bushing
4 = Plain washer
5 = Plain washer
6 = Positioning lever
7 = Adjusting lever
8 = Control lever
9 = Connecting nut
10 = Cylindrical helical coiled spring
11 = Plain washer

INDIVIDUAL COMPONENTS OF SPRING-TYPE LOAD IMPACT DAMPING



1 = Compression spring (damping spring)
2 = Compression spring (compensating spring)
3 = Clamping lever
4 = Intermediate lever

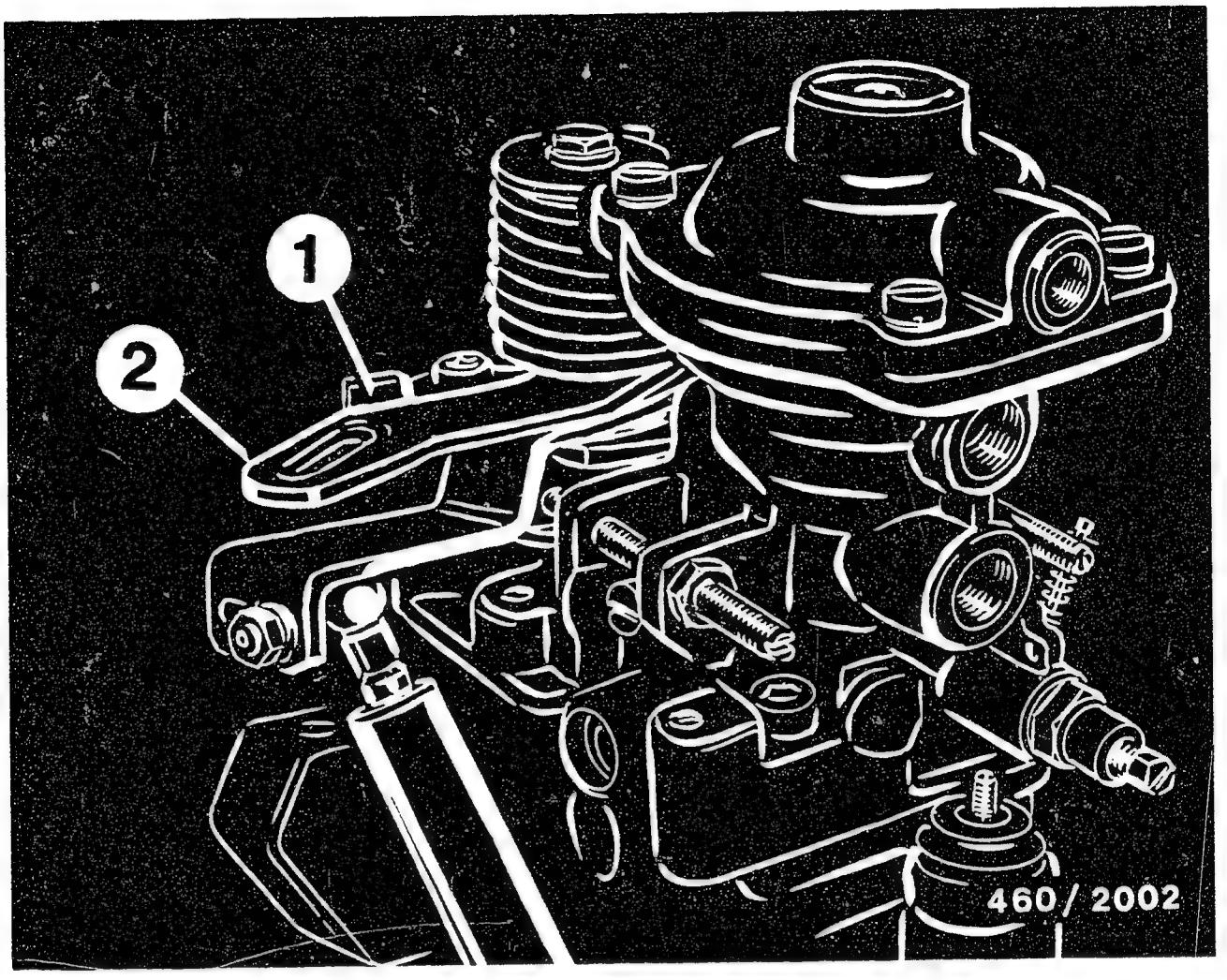
FUNCTIONAL DESCRIPTION OF MECHANICAL LOAD-IMPACT DAMPING

The spring (damping spring) fitted between clamping lever and at intermediate lever is compressed when the accelerator pedal is actuated from "idle" irrespective of engine speed.

In this process only the damper rate is made available to the engine, so as to avoid acceleration load impact.

The clamping lever does not effect transfer to the governor springs until the idle-motion spring has completed its travel. This slows down the increase in quantity.

The hydraulic damper fitted on the side counteracts the engine-speed control lever if the accelerator pedal is depressed suddenly.



1 = Adjusting lever 2 = Control lever

FUNCTIONAL DESCRIPTION OF SPRING-TYPE LOAD IMPACT DAMPING

No damping rate is set with the spring-type load impact damping system.

The adjusting lever follows the control lever and decelerates the quantity of fuel injected in the event of sudden actuation of the accelerator pedal from the idle position irrespective of engine speed.

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After-Sales Service Department for Training and Technology (KH/VSK)
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SEALING OF RQ(V) GOVERNORS

Workshop: EP
11.1988

0138 En

The sealing of the full-load stop on RQ governors and the maximum-speed stop on RQV governors has been altered.

Use is gradually to be made of the new sealing cap 2 420 580 005 on all these governors coming into series production.

The sealing cap 2 420 580 005 is red, so as to make it possible to establish in retrospect and at any time that the fuel-injection-pump combination has been subject to service adjustment.

As opposed to the service sector, the factory employs black sealing caps with a different part number.

To effect sealing, the sealing cap is first positioned by hand over the head of the full-load or maximum-speed stop screw and pressed into the locating groove of the corresponding lock nut using the sealing tool KDEP 1619.

The sealing tool KDEP 1619 is used in such a manner that the fixed stop of the tool is supported by the back of the governor housing.

The sealing cap is pressed over the lock nut by the moving arm of the device with recess in that the knurled nut of the device is turned until the sealing cap engages in the locating groove of the lock nut.

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DISTRIBUTOR-TYPE FUEL-INJECTION PUMP 0 460 494 144

Workshop: EP
11.1988

Conversion on account of complaint about
"bucking when driving"

0139 En

If complaints are received about "bucking when driving" in conjunction with the Lancia, Prisma Diesel passenger car, the situation can be alleviated by fitting the following service parts:

Item SP list	Part No.	Designation
55	1 468 522 446	Del.-vlv. assemb.
57	1 460 100 002	Plain washer
58	1 463 370 342	Fitting
68	1 463 161 766	Part-load regul.

The service parts indicated are put to series use in the dis.-type fuel-inj. pump 0 460 494 238 (L 157-1). The dis.-type fuel inj. pump L 157-1 has been installed in the above-men. vehicle since 8.88 as a successor to the L 157.

Following conversion work, the desig. of the dis.-type fuel-inj. pump is to be changed from L 157 to L 157-1. The dis.-type fuel.inj. pump is to be tested/adjusted in accordance with test-specification sheet L 157-1.

The costs of the conversion work are to be billed even during the warranty period.

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SIZE P IN-LINE PUMPS

Workshop: EP
11.1988

Roller-tappet seizure with Iveco vehicles

0144 En

Complaints concerning roller-tappet seizure may be encountered with Iveco vehicles featuring the following in-line pumps:

PE 6 P 120 A 720 RS 3123	– 0 411 826	731
RS 3192	– ..	761
RS 3195	– ..	762

Such complaints can generally be attributed to a lack of lubricating oil in the fuel-injection pump.

In order to avoid such complaints, fuel-injection pumps up to date of manufacture 748 (8.87) are to be retrofitted with a special inlet-union screw (Iveco service part with part no. 483 3934). When doing so, attention is to be paid to the following:

* In the case of fuel-injection pumps up to date of manufacture 746 (6.87), the existing screw-thread insert (helicoil) is to be carefully bent to one side (not in the direction of the inside of the pump), so as to enable the inlet-union screw to be fitted.

* As of date of manufacture 746, there is no screw-thread insert in the pump housing.

* When disassembling the fuel-injection pump, care is to be taken to ensure that the inlet-union screw is removed before removing the camshaft.

Such retrofitting is not necessary with fuel-injection pumps as of date of manufacture 749 (9.87). Such fuel-injection pumps are fitted as standard by Iveco with this inlet-union screw.

If complaints are recieved concerning roller-tappet seizure, a check is therefore to be made to establish whether the special inlet-union screw has been fitted (if necessary by making enquiries where removal was performed). If this is the case and if roller-tappet seizure nevertheless occurs, warranty procedure is to be implemented as follows.

In countries outside Germany:

After-sales-service workshops should send the exchanged parts during the warranty period to their authorized Bosch representative for assessment together with the request for warranty and goodwill coverage "Overseas G 21".

Repairs are to be performed and billed in the event of fuel-injection pumps not featuring this special inlet-union screw.

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Technical After-Sales Service (KH/VKD 2)

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ADJUSTMENT OF DELIVERY ON IN-LINE PUMPS OF SIZE P MOUNTED ON SCANIA ENGINES

Workshop: EP
12.1988

0141 En

On in-line pumps of size P which are mounted on engines of the D8, DN8, DS8, DSI8, DS9, DSC9, DN11, DS11, DSI11, DSC11, DS14, DSC14, and DSI14 series, Scania resets the full-load deliveries for higher or lower levels of power.

The pumps are identified by an additional letter after the type designation of the pump and sometimes after the part number of the assembly. A reference to this Technical Bulletin is included with the appropriate test specifications in the case of exchange.

For the D11 engine, the delivery settings are listed on the test-specification sheet SCA11,On. (See in each case the latest edition on microcard WP-..).

N o t e :

The injection-pump assemblies may be adjusted only in accordance with the pump designation and identification.

Use only the most recent valid test specifications on microcard WP... . Other injected fuel quantities may lead to engine damage and thus to claims for compensation by the engine/vehicle owners.

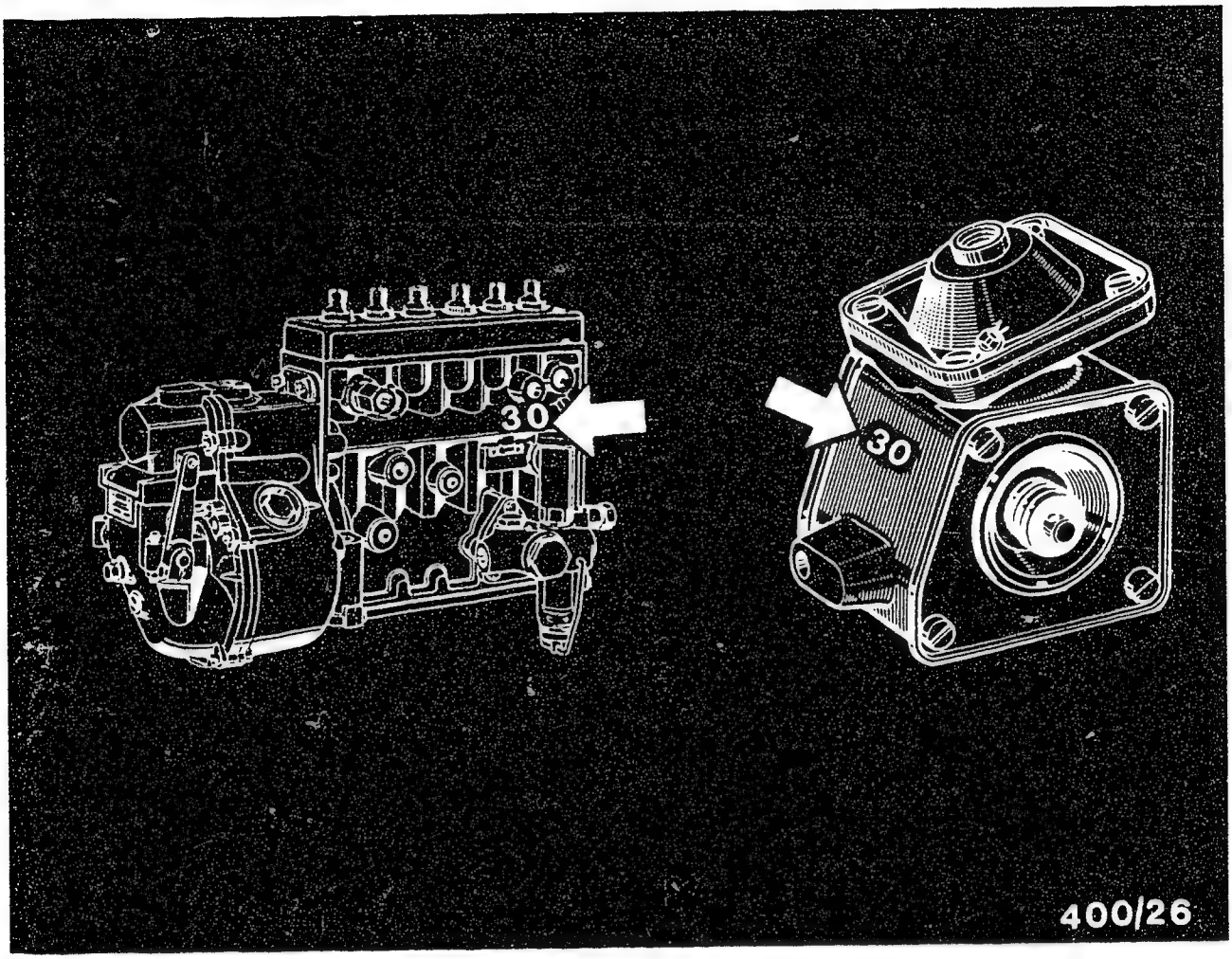
In the case of replacement orders of complete injection-pump assemblies, only the assembly with the basic adjustment is supplied; this means that whenever a marked (identification) injection pump is replaced, the fuel delivery must be adjusted and the pump marked with its identification accordingly.

For readjusting, always use the test specifications for the basic assembly without suffixed letters, if there is no separate test-specification sheet available. Afterwards, the necessary correction to the full-load delivery should be performed.

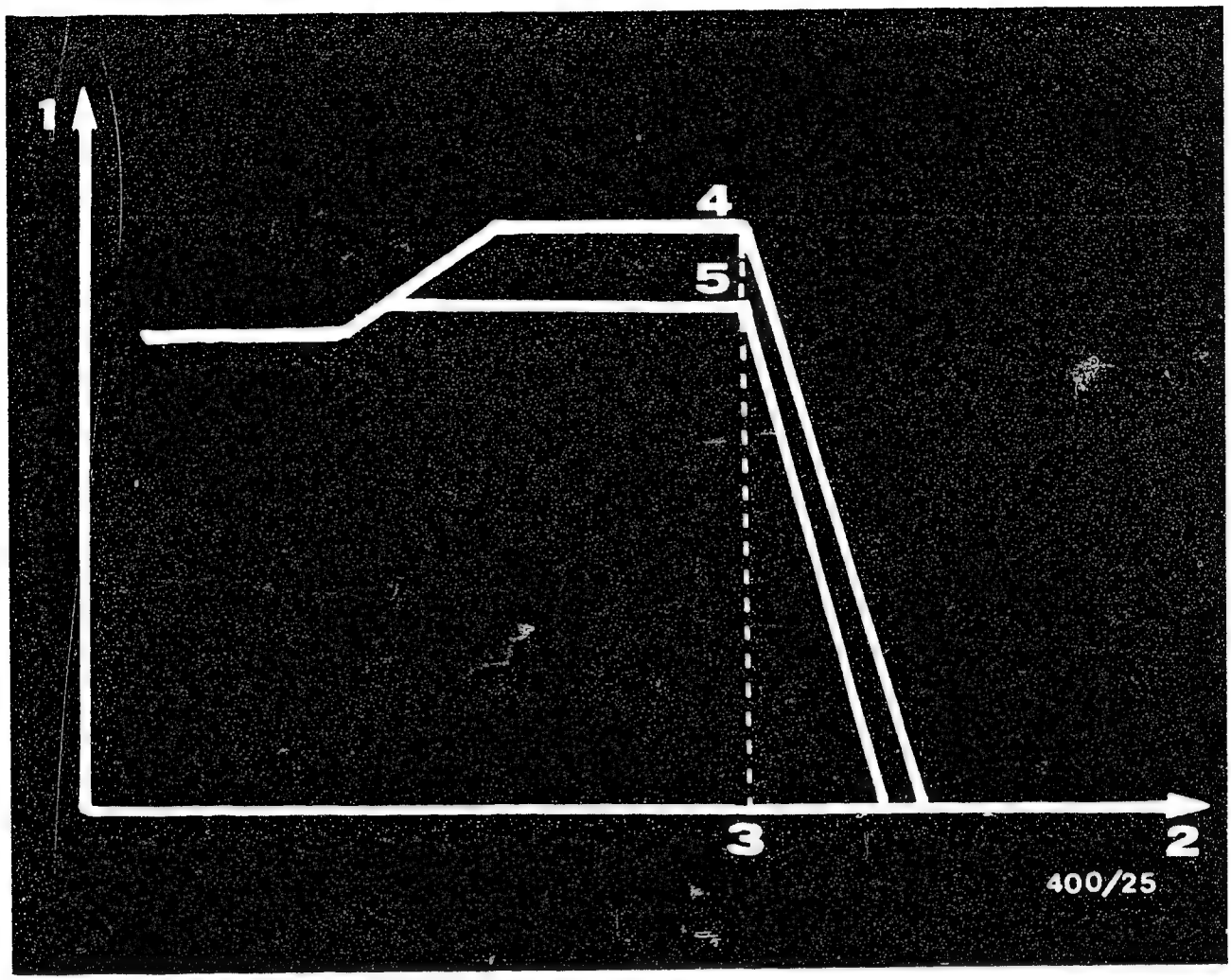
On injection-pump assemblies manufactured in Brazil the full-load control-rod travel is engraved in coded form either in the pump housing or in the manifold-pressure-compensator (LDA) housing. This figure indicates the magnitude of the full-load control-rod travel in tenths of a millimeter over a control-rod-travel distance of 10 mm.
Example:

Engraved No.		Full-load pos. of control rod
30	=	10 + 30 x 0.1 mm = 13.0 mm
35	=	10 + 35 x 0.1 mm = 13.5 mm
39	=	10 + 39 x 0.1 mm = 13.9 mm

When a pump housing or LDA housing is replaced, the engraved number is to be transferred from the old housing to the new one.



Pos. of engraved no. on pump or LDA housing (arrow)



1 = Control-rod travel (mm)
2 = Engine speeds n (min-1)
3 = Maximum rated speed
4 = Full-load control-rod travel with charge-air pressure
5 = Full-load control-rod travel without charge-air pressure

If due to the reduction of delivery, the full-load control-rod travel (4) becomes smaller than the full-load control-rod travel (5), adjustment of the manifold-pressure compensator (LDA) is no longer necessary.
The fuel deliveries given in the tables have been compiled in accordance with Saab-Scania documentation.

Engine	Pump	Governor
D8	PE 6 P 110 A 720 RS 261	RQV..170R, EP/RSV..310 R
Assy. No. 0 401 846 364 / 0 401 876 175		

Pump S261..	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Control-rod-travel change on full-load adjustment
	1200	900	750	600	
X	84	81	78	72	- 0.7 mm
Z	80	75	71	64	- 1.2 mm
N	76	70	64	55	- 1.7 mm
M	71	63	57	47	- 2.3 mm
L	66	57	52	43	- 2.8 mm
K	60	52	46	37	- 3.3 mm
J	56	49	44	34	- 3.6 mm
I	51	46	41	31	- 3.9 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DN8	PE 6 P 110 A 720 RS 393	RQV200/1200 PA 224 RQV250/1200 PA 469 RQ 750 PA 528 RQ 900 PA 528 RSV833 110

Assy. No. 0 401 846 423, ..424, ..479, ..480
0 401 876 240

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1			Control-rod-travel change on full-load adjustment
	600	700	850	
S	83	87	92	- 0.3 mm
X	77	81	87	- 0.6 mm
Q	73	78	84	- 0,9 mm
Z	67	74	80	- 1.2 mm
O	64	71	78	- 1.4 mm
N	60	67	75	- 1.7 mm
M	55	62	70	- 2.1 mm
L	50	57	65	- 2.6 mm
K	46	52	60	- 3.0 mm
J	42	48	56	- 3.4 mm
I	38	45	51	- 3.8 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS8	PE 6 P 110 A 720 RS 3012 PE 6 P 110 A 720 RS 3013 PE 6 P 110 A 720 RS 3034 PE 6 P 110 A 720 RS 3035	RQV..275R EP/RSV..310R RQV .. 275 R EP/RSV..310 R
Assy. No. 0 401 846 705 0 401 876 703, ..708, ..709		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Control-rod-travel change on full-load adjustment
	1200	900	750	600	
T	121	118	118	118	+ 0.3 mm
S	113	109	108	107	- 0.2 mm
X	109	105	102	101	- 0.5 mm
Q	106	102	99	97	- 0.7 mm
Z	102	98	94	91	- 1.0 mm
O	100	95	91	86	- 1.2 mm
N	96	92	87	80	- 1.5 mm
M	91	86	80	69	- 1.9 mm
L	86	81	74	60	- 2.3 mm
K	80	74	66	51	- 2.8 mm
J	77	71	63	46	- 3.1 mm
I	73	67	58	41	- 3.5 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS8 05,06	PE 6 P 110 A 720 RS 3034	RQV 200–1200 PA 554
40		RQV 200–1200 PA 554
DS8 05 Crane	PE 6 P 110 A 720 RS 3034 Z	RQV 275–1200 PA 554–1
		RQV 200–1100 PA 657–4
		RSUV 833110
Assy. No. 0 401 876 715		RSV
0 401 846 733, ..770, ..790		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control-rod-travel change on full-load adjustment
	700	
S	117	– 0.2 mm
X	110	– 0.5 mm
Q	106	– 0.7 mm
Z	102	– 1.0 mm
O	98	– 1.2 mm
N	93	– 1.5 mm
M	85	– 1.9 mm
L	78	– 2.4 mm
K	72	– 2.8 mm
J	66	– 3.2 mm
I	60	– 3.6 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS 8 42	PE 6 P 110 A 720 RS 3076	RQ 750 PA 528 RQ 900 PA 528
Assy. No. 0 401 846 775, ..776		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1		Control-rod-travel change on full-load adjustment
	700	850	
Y	129	131	+ 0.5 mm
T	125	127	+ 0.3 mm
S	114	118	- 0.2 mm
X	107	112	- 0.5 mm
Q	103	108	- 0.8 mm
Z	96	103	- 1.1 mm
O	93	100	- 1.3 mm
N	88	96	- 1.5 mm
M	81	89	- 2.0 mm
L	75	83	- 2.4 mm
K	69	78	- 2.8 mm
J	63	71	- 2.3 mm
I	56	65	- 3.7 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DSI8 01	PE 6 P 110 A 720 RS 3034	RQV 200–1200 PA 520
DSI8 01 Crane		RQV 275–1200 PA 529–1
Assy. No. 0 401 846 732, ..791		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	126	– 0.2 mm
X	120	– 0.5 mm
Q	115	– 0.7 mm
Z	108	– 1.0 mm
O	104	– 1.2 mm
N	99	– 1.5 mm
M	90	– 2.0 mm
L	82	– 2.5 mm
K	75	– 2.9 mm
J	69	– 3.4 mm
I	63	– 3.8 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DSI 8 41	PE 6 P 110 A 720 RS 3076	RQ 750 PA 528 – 1 RQ 900 PA 528 – 2
Assy. No. 0 401 846 777, ..778		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min-1		Control-rod-travel change on full-load adjustment
	700	850	
S	129	131	– 0.2 mm
X	123	125	– 0.5 mm
Q	119	121	– 0.7 mm
Z	112	116	– 1.0 mm
O	106	111	– 1.3 mm
N	100	106	– 1.6 mm
M	92	99	– 2.0 mm
L	83	92	– 2.5 mm
K	76	85	– 3.0 mm
J	71	79	– 3.4 mm
I	65	73	– 3.8 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS9 01	PE 6 P 120 A 320 RS 7102	RQV 200–1100 PA 712–1
03	PE 6 P 120 A 320 RS 7102	RQV 200–1100 PA 712
	PE 6 P 120 A 320 RS 7102	RQ 200/1000 PA 745

Assy. No. 0 402 746 800,
0 402 646 822, ..833

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	160	– 0.1 mm
X	154	– 0.4 mm
Q	151	– 0.6 mm
Z	145	– 0.9 mm
O	140	– 1.1 mm
N	134	– 1.4 mm
M	126	– 1.9 mm
L	119	– 2.3 mm
K	112	– 2.7 mm
J	107	– 3.0 mm
I	102	– 3.3 mm
H	96	– 3.6 mm
G	91	– 3.8 mm

The test specifications apply for calibration oil ISO – 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DC9	PE 6 P 120 A 320 RS 7103	RQV 200–1100 712
Assy. No. 0 402 746 801		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	174	– 0.4 mm
X	168	– 0.9 mm
Q	164	– 1.2 mm
Z	158	– 1.6 mm
O	154	– 1.9 mm
N	146	– 2.4 mm
M	135	– 3.1 mm
L	126	– 3.7 mm
K	118	– 4.1 mm
J	112	– 4.4 mm
I	105	– 4.7 mm
H	99	– 5.0 mm
G	93	– 5.3 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
D 11	PE 6 P 110 A 720 RS 3022	RQV 250...1100 PA 183 R
	PE 6 P 110 A 720 RS 3022	RSV 350...900 P7/ 351 R
	PE 6 P 110 A 720 RS 3022	RSV 350...1100 P1/351 R
	PE 6 P 110 A 720 RS 3065	RQV 250...1100 PA 468
	PE 6 P 110 A 720 RS 3065	RQV 250...1100 PA 600
	PE 6 P 110 A 720 RS 3065	RSV 350...900 P7/468
	PE 6 P 110 A 720 RS 3065	RSV 350...1100 P1/468
	PE 6 P 110 A 720 RS 3065	RSV 350...900 P7/481
	PE 6 P 110 A 720 RS 3065	RSV 350...1100 P1/481
Assy. No.	9 400 087 238	
	9 400 087 248	
	9 400 087 247	
	0 401 846 721	
	9 400 087 275	
	9 400 087 265	
	9 400 087 266	
	9 400 087 286	
	0 401 876 719	

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed min-1				Change in control-rod travel given change in full load
	1100	900	750	600	
t	138	136	138	136	+ 0.2 mm
x	126	123	125	124	- 0.5 mm
q	122	120	120	120	- 0.7 mm
z	117	114	114	113	- 1.0 mm
o	114	110	109	108	- 1.2 mm
n	111	106	105	104	- 1.4 mm
m	106	101	98	96	- 1.7 mm
l	99	94	90	86	- 2.1 mm
k	94	88	83	76	- 2.5 mm
j	89	84	77	68	- 2.8 mm
i	83	77	70	59	- 3.3 mm

The test specifications apply to calibrating oil as per ISO 4113.

Engine	Pump	Governor
DN 11	PE 6 P 110 A 720 RS 3115	RQV 200...1100 PA 468 RQV 350...1100 PA 468
Assy. No. 0 401 846 764 9 400 087 359		

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed.. min-1					Change in control-rod travel given change in full load
	1100	900	750	700	600	
y	134	134	135	136	136	+ 0.8 mm
t	129	127	128	129	129	+ 0.5 mm
s	117	115	114	114	113	- 0.3 mm
x	113	110	109	108	106	- 0.6 mm
q	109	106	105	104	101	- 0.8 mm
z	105	101	99	98	94	- 1.1 mm
o	103	99	96	94	91	- 1.3 mm
n	99	94	90	88	84	- 1.6 mm
m	93	88	82	80	75	- 2.0 mm
l	87	82	75	72	65	- 2.5 mm
k	82	76	69	66	58	- 2.9 mm
j	77	70	63	59	50	- 3.3 mm
i	73	65	58	54	45	- 3.7 mm
h	68	60	53	49	42	- 4.1 mm
g	64	56	49	46	40	- 4.4 mm

The test specifications apply to calibrating oil as per ISO 4113.

Engine	Pump	Governor
DN11 01 04	PE 6 P 120 A 720 RS 3065	RQV 250–1100 PA 468 RQ 250/1100 PA 470 RSV 350–1100 P1/481

Assy. No. 0 401 846 721, ..722, ..722 X
876 719

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control-rod-travel change on full-load adjustment
S	132	– 0.2 mm
X	126	– 0.5 mm
Q	122	– 0,7 mm
Z	117	– 1.0 mm
O	114	– 1.2 mm
N	111	– 1.4 mm
M	106	– 1.7 mm
L	99	– 2.1 mm
K	94	– 2.5 mm
J	89	– 2.8 mm
I	83	– 3.3 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DN11 01	PE 6 P 110 A 720 RS 3115	RQV 200–1100 PA 468 RQ 299/1100 PA 719 RSV 350–1100 P1/481
Assy. No. 0 401 846 764, ..800 0 401 876 728		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control–rod–travel change on full–load adjustment
	600	
S	113	– 0.3 mm
X	106	– 0.6 mm
Q	101	– 0.8 mm
Z	94	– 1.1 mm
O	91	– 1.3 mm
N	84	– 1.6 mm
M	75	– 2.0 mm
L	65	– 2.5 mm
K	58	– 2.9 mm
J	50	– 3.3 mm
I	45	– 3.7 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DN11 06 07	PE 6 P 120 A 720 RS 7001	RQV 200–1100 PA 612 RQ 200/1000 PA 615
Assy. No. 0 402 646 807, ..808		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 600	Control–rod–travel change on full–load adjustment
S	152	– 0.2 mm
X	141	– 0.6 mm
Q	137	– 0.8 mm
Z	130	– 1.1 mm
O	128	– 1.2 mm
N	122	– 1.5 mm
M	117	– 1.8 mm
L	109	– 2.2 mm
K	105	– 2.5 mm
J	102	– 2.8 mm
I	98	– 3.1 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 680 750 015.

Engine	Pump	Governor
DN 11 40	PE 6 P 120 A 720 RS 7004	RQ 750 PA 528 – 2 RQ 900 PA 528 – 2
Assy. No. 0 402 646 815, .. 814		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1		Control–rod–travel change on full–load adjustment
	700	850	
S	152	159	– 0.2 mm
X	147	155	– 0.5 mm
Q	144	152	– 0.6 mm
Z	139	147	– 0.9 mm
O	136	143	– 1.1 mm
N	130	138	– 1.3 mm
M	123	130	– 1.7 mm
L	116	122	– 2.1 mm
K	109	116	– 2.4 mm
J	103	109	– 2.7 mm
I	98	103	– 3.0 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 11	PE 6 P 110 A 720 RS 3006 PE 6 P 110 A 720 RS 3016 PE 6 P 110 A 720 RS 3014	RQV .. 242 R EP/RSV.. 310 R EP/RSV.. 310 R
Assy. No. 0 401 846 703 0 401 876 702, ..704		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Control-rod-travel change on full-load adjustment
	1100	900	750	600	
P	198	202	202	204	+ 2.1 mm
U	188	189	188	192	+ 1.6 mm
R	183	185	184	187	+ 1.4 mm
W	178	178	178	181	+ 1.0 mm
V	175	175	174	177	+ 0.8 mm (Case-USA)
Y	170	170	169	171	+ 0.5 mm
T	168	167	166	167	+ 0.3 mm
S	158	159	158	159	- 0.2 mm
X	152	154	153	154	- 0.4 mm
Q	148	151	150	150	- 0.6 mm
Z	143	146	146	146	- 0.8 mm
O	139	142	142	142	- 1.0 mm
N	133	134	136	135	- 1.3 mm
M	124	125	127	126	- 1.7 mm
L	116	115	117	114	- 2.1 mm
K	108	106	105	102	- 2.5 mm
J	101	97	96	92	- 2.9 mm
I	94	90	88	85	- 3.4 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS 11	PE 6 P 100 A 720 RS 202 PE 6 P 100 A 720 RS 203	RQV .. 167 R, 168 R EP/RSV.. 310 R
Assy. No. 0 401 846 233, ..234, ..240 0 401 876 126, ..134		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Control-rod-travel change on full-load adjustment
	1100	900	750	600	
W*	176	179	181	182	+ 0.9 mm
V*	172	174	176	176	+ 0.7 mm
Y*	168	170	172	171	+ 0.5 mm
T	165	166	168	164	+ 0.3 mm
S	156	157	157	152	- 0.2 mm
X	151	152	152	147	- 0.5 mm
Q	147	148	148	143	- 0.7 mm
Z	142	143	142	137	- 1.0 mm
O	138	139	137	133	- 1.2 mm
N	133	135	132	127	- 1.6 mm
M	124	125	122	116	- 2.1 mm
L	114	115	111	104	- 2.7 mm
K	104	105	100	93	- 3.2 mm
J	97	96	90	83	- 3.7 mm
I	89	86	80	73	- 4.3 mm

* Start of delivery with these variants at prestroke = 2.4...2.5 mm from BDC

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS 11	PE 6 P 110 A 720 RS 3014	RSV 350... 900 P7/351 R
	PE 6 P 110 A 720 RS 3014	RSV 350...1100 P1/351 R
	PE 6 P 110 A 720 RS 3021	RQV 250...1100 PA 242 R
	PE 6 P 110 A 720 RS 3066	RSV 350...1100 P1/462
Assy. No.	9 400 087 245, ..244, ..237	
	0 401 876 714	

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Change in control-rod travel given change in full load
	1100	900	750	600	
p	198	202	202	204	+ 2.1 mm
u	188	189	188	192	+ 1.6 mm
r	183	185	184	187	+ 1.4 mm
w	178	178	178	181	+ 1.0 mm
v	175	175	174	177	+ 0.8 mm
y	170	170	169	171	+ 0.5 mm
t	168	167	166	167	+ 0.3 mm
s	158	159	158	159	- 0.2 mm
x	152	154	153	154	- 0.4 mm
q	148	151	150	150	- 0.6 mm
z	143	146	146	146	- 0.8 mm
o	139	142	142	142	- 1.0 mm
n	133	134	136	135	- 1.3 mm
m	124	125	127	126	- 1.7 mm
l	116	115	117	114	- 2.1 mm
k	108	106	105	102	- 2.5 mm
j	101	97	96	92	- 2.9 mm
i	94	90	88	85	- 3.4 mm

The test specifications apply to calibrating oil as per ISO 4113.

Engine	Pump	Governor
DS 11	PE 6 P 110 A 720 RS 3040	RQV 250...1100 PA 599
	PE 6 P 110 A 720 RS 3040	RSV 350...1100 P1/481
	PE 6 P 110 A 720 RS 3041	RSV 350...1100 P1/351
Assy. No.	9 400 087 274	
	0 401 876 720	
	9 400 087 251	

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Change in control-rod travel given change in full load
	1100	900	750	600	
p	205	208	212	214	+ 2.6 mm
u	191	196	198	200	+ 1.9 mm
r	186	191	192	195	+ 1.7 mm
w	180	185	185	188	+ 1.3 mm
v	175	179	179	183	+ 1.0 mm
y	170	173	172	177	+ 0.7 mm
t	166	167	166	171	+ 0.4 mm
s	154	156	156	158	- 0.2 mm
x	146	149	149	150	- 0.5 mm
q	141	145	145	146	- 0.8 mm
z	134	138	139	140	- 1.1 mm
o	131	134	136	137	- 1.3 mm
n	124	126	130	131	- 1.6 mm
m	114	115	119	121	- 2.1 mm
l	105	106	108	111	- 2.6 mm
k	98	98	98	99	- 3.0 mm
j	89	90	90	90	- 3.4 mm
i	86	84	83	80	- 3.8 mm

The test specifications apply to calibrating oil as per ISO 4113.

Engine	Pump	Governor
DS 11; (DSC 11)	PE 6 P 120 A 720 RS 7001	RQV 200...1000 PA 539
Assy. No. 0 402 646 801		

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1					Change in control-rod travel given change in full load
	1100	1000	900	700	600	
u	237	236	237	242	246	+ 1.9 mm
r	230	229	230	235	240	+ 1.6 mm
w	224	223	223	228	232	+ 1.3 mm
v	218	218	218	221	224	+ 1.0 mm
y	212	212	213	215	217	+ 0.7 mm
t	204	203	203	206	210	+ 0.4 mm
s	194	193	192	195	197	- 0.2 mm
x	186	184	183	185	188	- 0.6 mm
q	183	180	179	180	183	- 0.8 mm
z	176	173	172	173	176	- 1.1 mm
o	173	170	169	169	171	- 1.3 mm
n	168	164	163	162	164	- 1.6 mm
m	161	157	155	153	154	- 2.0 mm
l	153	150	147	143	142	- 2.5 mm
k	146	144	141	135	134	- 2.9 mm
j	138	135	132	126	123	- 3.4 mm
i	131	128	125	119	115	- 3.8 mm

The test specifications apply to calibrating oil as per ISO 4113, as well as to calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DS 11 Assy. No. 0 402 646 804	PE 6 P 120 A 720 RS 7004	RQ 900 PA 528

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed ..min-1			Change in control-rod travel given change in full load
	1000	850	700	
d	283	281	272	+ 2.7 mm
u	264	264	257	+ 2.1 mm
r	255	255	251	+ 1.8 mm
w	242	241	240	+ 1.3 mm
v	234	231	233	+ 1.0 mm
y	226	221	224	+ 0.6 mm
t	221	215	217	+ 0.3 mm
s	211	206	204	- 0.2 mm
x	206	199	197	- 0.5 mm
q	202	194	192	- 0.7 mm
z	197	189	184	- 1.0 mm
o	193	184	179	- 1.2 mm
n	187	178	171	- 1.5 mm
m	176	168	159	- 2.0 mm
l	168	160	152	- 2.4 mm
k	157	150	142	- 2.9 mm
j	148	142	134	- 3.3 mm
i	139	134	127	- 3.7 mm

The test specifications apply to calibrating oil as per ISO 4113, as well as to calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DS 11-E Alcohol*	PE 6 P 120 A 720 RS 7013	RQV 200...1000 PA 715

Assy. No. 9 400 087 303

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed ..min-1					Change in control-rod travel given change in full load
	1050	1000	900	700	600	
w	291	292	291	289	293	+ 0.9 mm
v	284	285	285	285	287	+ 0.7 mm
y	275	277	278	279	278	+ 0.5 mm
t	269	271	272	275	273	+ 0.3 mm
s	259	259	259	265	263	- 0.2 mm
x	253	252	250	258	256	- 0.4 mm
q	250	248	245	254	253	- 0.6 mm
z	245	242	237	248	247	- 0.9 mm
o	241	238	233	243	243	- 1.1 mm
n	236	234	226	236	237	- 1.4 mm
m	228	225	217	223	225	- 1.9 mm
l	219	217	208	210	213	- 2.3 mm
k	209	207	200	198	201	- 2.8 mm
j	198	196	190	185	188	- 3.3 mm
i	186	184	180	173	174	- 3.8 mm

The test specifications apply to calibrating oil as per ISO 4113, as well as to calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

* Alcohol equipment. Brazilian market only.

Engine	Pump	Governor
DS11 01	PE 6 P 110 A 720 RS 3040	RQV 250–1100 PA 379 R RQ 250/1100 PA 411 R
DS11 11		RQV 200–1050 PA 379

Assy. No. 0 401 846 710, ..717, ..724

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 600	Control–rod–travel change on full–load adjustment
T	171	+ 0.4 mm
S	158	– 0.2 mm
X	153	– 0.5 mm
Q	150	– 0.6 mm
Z	144	– 0.9 mm
O	140	– 1.1 mm
N	132	– 1.5 mm
M	119	– 2.0 mm
L	107	– 2.5 mm
K	96	– 2.9 mm
J	86	– 3.3 mm
O	78	– 3.7 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS11 05 Assy. No. 0 401 876 720	PE 6 P 110 A 720 RS 3040	RSV 350–1100 P1/481

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control–rod–travel change on full–load adjustment
	1100	
S	153	– 0.2 mm
X	147	– 0.5 mm
Q	140	– 0.8 mm
Z	134	– 1.1 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS11 05 Case	PE 6 P 110 A 720 RS 3040-1	RSV 350-1100 P1/505
Assy. No. 0 401 876 734		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1	Control-rod-travel change on full-load adjustment
	1100	
S	153	- 0.2 mm
X	147	- 0.5 mm
Q	140	- 0.8 mm
Z	134	- 1.1 mm

The test specifications apply for calibration oil to ISO - 4113

Engine	Pump	Governor
DS11 14	PE 6 P 110 A 720 RS 3040	RQV 200–1000 PA 555
Assy. No. 0 401 846 734		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 600	Control-rod-travel change on full-load adjustment
S	170	– 0.3 mm
X	162	– 0.7 mm
Q	158	– 0.9 mm
Z	153	– 1.2 mm
O	150	– 1.3 mm
N	144	– 1.6 mm
M	132	– 2.2 mm
L	119	– 2.7 mm
K	107	– 3.2 mm
J	96	– 3.6 mm
I	86	– 4.0 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS11 14 DS11 14 – Crane	PE 6 P 110 A 720 RS 3040	RQV 200–1000 PA 555–1 RQV 275–1000 PA 555–2
Assy. No. 0 401 846 763, .. 795		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1	Control–rod–travel change on full–load adjustment
	700	
S	164	– 0.2 mm
X	158	– 0.5 mm
Q	154	– 0.7 mm
Z	148	– 1.0 mm
O	143	– 1.2 mm
N	137	– 1.5 mm
M	128	– 2.0 mm
L	118	– 2.5 mm
K	108	– 2.9 mm
J	99	– 3.4 mm
I	89	– 3.8 mm

The test specifications apply for calibrating oil to ISO – 4113

Engine	Pump	Governor
DS11 15, 18	PE 6 P 120 A 720 RS 7001	RQV 200–1000 PA 539 RQV 200–1050 PA 539 RQV 200/1000 PA 616 RQV 275–1000 PA 539–4
DS11 15 – Crane		
Assy. No. 0 402 646 801, ..802, ..809 0 402 646 817		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	195	– 0.2 mm
X	185	– 0.6 mm
Q	180	– 0.8 mm
Z	173	– 1.1 mm
O	169	– 1.3 mm
N	162	– 1.6 mm
M	153	– 2.0 mm
L	143	– 2.5 mm
K	135	– 2.9 mm
J	126	– 3.4 mm
I	119	– 3.8 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS11 25, 26 28, 33 Assy. No. 0 402 646 819	PE 6 P 120 A 720 RS 7001	RQV 200/1100 PA 713

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1 700	Control-rod-travel change on full-load adjustment
W	181	+ 0.9 mm
V	177	+ 0.7 mm
Y	171	+ 0.5 mm
T	167	+ 0.3 mm
S	159	- 0.1 mm
X	153	- 0.4 mm
Q	149	- 0.5 mm
Z	144	- 0.8 mm
O	141	- 0.9 mm
N	136	- 1.1 mm
M	129	- 1.5 mm
L	122	- 1.9 mm
K	116	- 2.3 mm
J	110	- 2.6 mm
I	104	- 3.0 mm
H	98	- 3.4 mm
G	93	- 3.7 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DS11 40, 41, 42 DSI11 40, 44 Assy. No. 0 402 676 800	PE 6 P 120 A 720 RS 7001	RQV 350–1100 P 1/481

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
U	242	+ 1.9 mm
R	235	+ 1.6 mm
W	228	+ 1.3 mm
V	221	+ 1.0 mm
Y	215	+ 0.7 mm
T	208	+ 0.4 mm
S	195	– 0.2 mm
X	185	– 0.6 mm
Q	180	– 0.8 mm
Z	173	– 1.1 mm
O	169	– 1.3 mm
N	162	– 1.6 mm
M	153	– 2.0 mm
L	143	– 2.5 mm
K	135	– 2.9 mm
J	126	– 3.4 mm
I	119	– 3.8 mm

The test specifications apply for calibration oil ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 11 43, 44 45	PE 6 P 120 A 720 RS 7004	RQ 750 PA 528 RQ 900 PA 528
DSI 11 42, 45		RQ 1050 PA 528
Assy. No. 0 402 646 803, ..804, ..805		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1			Control-rod-travel change on full-load adjustment
	700	850	1000	
U	257	264	264	+ 2.1 mm
R	251	255	255	+ 1.8 mm
W	240	241	242	+ 1.3 mm
V	233	231	234	+ 1.0 mm
Y	224	221	226	+ 0.6 mm
T	217	215	221	+ 0.3 mm
S	204	206	211	- 0.2 mm
X	197	199	206	- 0.5 mm
Q	192	194	202	- 0.7 mm
Z	184	189	197	- 1.0 mm
O	179	184	193	- 1.2 mm
N	171	178	187	- 1.5 mm
M	159	168	176	- 2.0 mm
L	152	160	168	- 2.4 mm
K	142	150	157	- 2.9 mm
J	134	142	148	- 3.3 mm
I	127	134	139	- 3.7 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DSC11 01	PE 6 P 120 A 720 RS 7007	RQV 200–1000 PA 539–2
01 – Crane		
02		RQV 275–1100 PA 539–5
Assy. No. 0 402 646 812, ..818		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
Y	226	+ 1.3 mm
T	220	+ 0.8 mm
S	205	– 0.4 mm
X	196	– 1.1 mm
Q	191	– 1.6 mm
Z	183	– 2.1 mm
O	178	– 2.5 mm
N	172	– 3.0 mm
M	161	– 3.7 mm
L	152	– 4.3 mm
K	143	– 4.8 mm
J	135	– 5.3 mm
I	127	– 5.7 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DSC11 03 06	PE 6 P 120 A 720 RS 7015	RQV 200–1000 PA 768
Assy. No. 0 402 646 828		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	213	– 0.3 mm
X	204	– 0.6 mm
Q	199	– 0.9 mm
Z	190	– 1.2 mm
O	184	– 1.5 mm
N	175	– 1.8 mm
M	159	– 2.5 mm
L	148	– 3.0 mm
K	138	– 3.5 mm
J	129	– 4.0 mm
I	121	– 4.4 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14	PE 8 P 110 A 920/4 LS 302	RSV 350...900 P7/371 R
	PE 8 P 110 A 920/4 RS 322	RSV 350...950 P1/371 R
	PE 8 P 110 A 920/4 RS 322	RQV 225...1150 PA 88/2 R
Assy. No.	9 400 087 228	
	9 400 087 229	
	9 400 087 235	

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed ..min-1				Change in control-rod travel given change in full load
	1150	900	750	600	
z	143	145	143	138	- 1.0 mm

The specifications apply to calibrating oil as per ISO 4113.

Engine	Pump	Governor
DS 14	PE 8 P 110 A 920/4 RS 3020 PE 8 P 110 A 920/4 RS 3020 PE 8 P 110 A 920/4 LS 3038	RQV 250...1000 PA 306/2R RQV 250...1000 PA 633 RSV 350...900 P7/371 R RSV 350...1100 P1/371 R
Assy. No.	9 400 087 279 9 400 087 284 9 400 087 258 0 401 878 700	

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1				Change in control-rod travel given change in full load
	1100	900	750	600	
w	183	182	186	196	+ 1.3 mm
v	179	178	181	190	+ 1.0 mm
y	172	172	174	182	+ 0.7 mm
t	168	168	167	177	+ 0.4 mm
s	158	160	160	166	- 0.2 mm
x	152	154	155	160	- 0.5 mm
q	148	151	151	156	- 0.8 mm
z	141	146	146	150	- 1.1 mm
o	138	143	143	147	- 1.3 mm
n	132	138	138	143	- 1.6 mm
m	122	129	131	135	- 2.1 mm

The test specifications apply to calibrating oil as per ISO 4113.

Engine	Pump	Governor
DS 14	PE 8 P 110 A 920/4 LS 3055	RSV 350...900 P7/371 R
	PE 8 P 110 A 920/4 LS 3055	RSV 350...1100 P1/371 R
	PE 8 P 110 A 920/4 LS 3068	RSV 350...1100 P1/463
	PE 8 P 110 A 920/4 LS 3068	RSV 350...900 P7/469
Assy. No.	9 400 087 261	
	0 401 878 701	
	0 401 878 702	
	9 400 087 267	

Pump	Delivery in cm3/1000 (+/- 1.0) at engine speed ..min-1					Change in control-rod travel given change in full load
	1150	1100	900	750	600	
w		191	198	200	203	+ 1.5 mm
v		187	192	193	197	+ 1.2 mm
y		180	182	182	187	+ 0.7 mm
t		174	175	175	179	+ 0.4 mm
s		162	163	163	166	- 0.2 mm
x		155	159	157	159	- 0.5 mm
q		150	155	153	155	- 0.7 mm
z	138	142	149	148	148	- 1.0 mm
o		136	145	144	144	- 1.2 mm
n		129	137	138	137	- 1.5 mm
m		118	126	128	127	- 1.9 mm
l		111	117	120	118	- 2.3 mm
k		104	109	116	109	- 2.7 mm
j		99	101	103	101	- 3.1 mm
i		95	94	95	94	- 3.4 mm

The test specifications apply to calibrating oil as per ISO 4113.

Engine	Pump	Governor
DS 14	PE 8 P 120 A 920/4 LS 7002 PE 8 P 120 A 920/4 LS 7002	RQV 250...1000 PA 547 RSV 350...1100 P1/481
Assy. No.	0 402 648 801 9 400 087 287	

Pump	Delivery in cm3/1000 (+/- 0.1) at engine speed ..min-1						Change in control-rod travel given change in full load
	1050	1000	900	750	700	600	
u	223	224	226	231	229	233	+ 1.9 mm
r	217	217	218	225	224	227	+ 1.6 mm
w	210	211	211	218	218	220	+ 1.3 mm
v	204	205	205	211	210	213	+ 1.0 mm
y	198	199	198	205	204	207	+ 0.7 mm
t	192	193	190	194	195	198	+ 0.4 mm
s	180	182	179	182	184	186	- 0.2 mm
x	175	176	173	175	176	177	- 0.6 mm
q	171	171	168	169	170	171	- 0.8 mm
z	168	167	163	162	164	163	- 1.1 mm
o	164	164	160	158	159	159	- 1.3 mm
n	158	157	152	151	153	151	- 1.6 mm
m	151	150	144	141	145	140	- 2.1 mm
l	142	141	136	136	137	131	- 2.6 mm
k	134	132	130	132	131	125	- 3.0 mm
j	128	128	121	124	122	115	- 3.5 mm
i	118	118	117	115	114	109	- 4.0 mm

The test specifications apply to calibrating oil as per ISO 4113, as well as to calibrating nozzle-holder assembly 1 680 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14-E Alcohol *	PE 8 P 120 A 920/4 LS 7014	RQV 250...1000 PA 716
Assy. No. 9 400 087 304		

Pump	Delivery in cm3/1000 (+/- 0.1) at engine speed ..min-1					Change in control-rod travel given change in full load
	1050	1000	900	700	600	
t	272	274	275	277	275	+ 0.4 mm
s	260	258	260	264	262	- 0.2 mm
x	253	251	251	256	255	- 0.5 mm
q	249	246	246	251	251	- 0.7 mm
z	243	241	238	244	244	- 1.0 mm
o	239	237	233	239	240	- 1.2 mm
n	233	231	226	231	233	- 1.6 mm
m	221	220	215	216	219	- 2.1 mm
l	211	210	205	199	204	- 2.7 mm
k	199	200	195	184	190	- 3.2 mm
j	188	189	184	172	177	- 3.8 mm
i	179	178	173	163	164	- 4.3 mm

The test specifications apply to calibrating oil as per ISO 4113, as well as to calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

* = Alcohol equipment.
Brazilian market only.

Engine	Pump	Governor
DS 14 01 06	PE 8 P 110 A 920/4 LS 3020	RQV 250–1000 PA 306/2 R
Assy. No. 0 401 848 717		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 1000	Control–rod–travel change on full–load adjustment
X	154	– 0.5 mm
Z	145	– 1.1 mm
M	127	– 2.1 mm

The test specifications apply for calibration oil to ISO – 4113

Engine	Pump	Governor
DS 14 06, 07 DS 14 06 Crane	PE 8 P 120 A 920/4 LS 7002	RQV 250–1050 PA 547 RQV 200–1050 PA 547
Assy. No. 0 402 648 802		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	184	– 0.2 mm
X	176	– 0.6 mm
Q	170	– 0.8 mm
Z	164	– 1.1 mm
O	159	– 1.3 mm
N	153	– 1.6 mm
M	145	– 2.1 mm
L	137	– 2.6 mm
K	131	– 3.0 mm
J	122	– 3.5 mm
I	114	– 4.0 mm

The test specifications apply for calibration oil ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 06, 07 DS 14 06 Crane	PE 8 P 120 A 920/4 LS 7002	RQV 275–1000 PA 547–3
Assy. No. 0 402 648 810		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	184	– 0.2 mm
X	176	– 0.6 mm
Q	170	– 0.8 mm
Z	164	– 1.1 mm
O	159	– 1.3 mm
N	153	– 1.6 mm
M	145	– 2.1 mm
L	137	– 2.6 mm
K	131	– 3.0 mm
J	122	– 3.5 mm
I	114	– 4.0 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 06, 07 DS 14 06 Crane	PE 8 P 120 A 920/4 LS 7002	RQV 250–1000 PA 547 RQV 200–1000 PA 547
Assy. No. 0 402 648 810		

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	184	– 0.2 mm
X	176	– 0.6 mm
Q	170	– 0.8 mm
Z	164	– 1.1 mm
O	159	– 1.3 mm
N	153	– 1.6 mm
M	145	– 2.1 mm
L	137	– 2.6 mm
K	131	– 3.0 mm
J	122	– 3.5 mm
I	114	– 4.0 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 42 Case	PE 8 P 120 A 920/4 LS 7002-1	RSV 350-1050 P1/504
Assy. No. 0 402 648 810		

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1 700	Control-rod-travel change on full-load adjustment
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DSC 14 01	PE 8 P 120 A 920/4 LS	RQV 200–950 PA 547–1
DSC 14 01 Crane	7008	RQV 275–900 PA 547–4
DSC 14 02	..7008 X	RQV 200–950 PA 547–1
DSC 14 01	..7108	RQV 200–950 PA 736

Assy. No. 0 402 648 807, ..811, ..813, ..815

Pump	Fuel delivery in cm3/1000 (+/– 1.0) at engine speed .. min–1 700	Control–rod–travel change on full–load adjustment
S	192	– 0.4 mm
X	184	– 1.1 mm
Q	178	– 1.5 mm
Z	172	– 2.0 mm
O	168	– 2.3 mm
N	161	– 2.8 mm
M	155	– 3.4 mm
L	146	– 3.9 mm
K	139	– 4.3 mm
J	132	– 4.7 mm
I	126	– 4.9 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle–holder assembly 1 688 901 019 and test–pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 40,42 DSI 14 40,42 Assy.No. 0 402 678 800	PE 8 P 120 A 920/4 LS 7002	RSV 350-1100 P 1/484

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1	Control-rod-travel change on full-load adjustment
	700	
U	229	+ 1.9 mm
R	224	+ 1.6 mm
W	218	+ 1.3 mm
V	210	+ 1.0 mm
Y	204	+ 0.7 mm
T	195	+ 0.4 mm
S	184	- 0.2 mm
X	176	- 0.6 mm
Q	170	- 0.8 mm
Z	164	- 1.1 mm
O	159	- 1.3 mm
N	153	- 1.6 mm
M	145	- 2.1 mm
L	137	- 2.6 mm
K	131	- 3.0 mm
J	122	- 3.5 mm
I	114	- 4.0 mm

The test specifications apply for calibration oil to ISO-4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

Engine	Pump	Governor
DS 14 41	PE 8 P 120 A 920/4 LS 7003	RQV 750 PA 528
DSI 14 42, 43		RQV 900 PA 528
Assy. No. 0 402 648 803, ..804, ..805		RQV 1050 PA 528

Pump	Fuel delivery in cm3/1000 (+/- 1.0) at engine speed .. min-1			Control-rod-travel change on full-load adjustment
	700	850	1000	
U	246	241	243	+ 2.1 mm
R	238	235	237	+ 1.8 mm
W	231	227	231	+ 1.5 mm
V	223	219	224	+ 1.2 mm
Y	214	210	216	+ 0.8 mm
T	205	204	210	+ 0.4 mm
S	183	183	194	- 0.2 mm
X	179	180	190	- 0.4 mm
Q	173	177	187	- 0.6 mm
Z	165	171	180	- 0.9 mm
O	160	166	175	- 1.1 mm
N	154	161	170	- 1.4 mm
M	147	154	162	- 1.8 mm
L	140	147	154	- 2.2 mm
K	134	139	145	- 2.6 mm
J	126	132	137	- 3.0 mm
I	121	125	128	- 3.5 mm

The test specifications apply for calibration oil to ISO 4113, as well as calibrating nozzle-holder assembly 1 688 901 019 and test-pressure line 1 680 750 015.

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